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ARTICLE VII.

# ON FRACTURES.

By A. L. PEIRSON, M. D.,
Fellow of the Society.

[Read at the Annual Meeting, May 27, 1840.]

Mr. President and Gentlemen,

We are met in compliance with our time-honored custom of passing an hour together in the contemplation of some topic appropriate to our medical employments;—one hour in the year, which has no rivalry to stimulate, no jealousy to embitter, no perplexities to distract, no recompense to be toiled for; and yet it is an hour which, at each annual revolution, brings with it mingled emotions. It tells our younger brethren they have ascended one more step in the rugged and toilsome path of professional life; and to those who have reached its culminating point, it teaches, there is a decline as well as an ascent. It shows us the vacant seats, and calls to mind the absent forms, of

those whose course in life is run, and who are to mingle in the throng with us no more.* But, above all, it cannot fail to bring us a complacent satisfaction, in finding ourselves in the interchange of a social greeting with so large a number of those engaged in pursuits which all mankind deem to be useful, benevolent, and honorable. May the mutual respect, which is engendered here, go with us to our homes, and soften the asperity of professional competition, and diminish the violence of professional collision!

In looking for a subject to present to your minds to-day, I have sought no untravelled path. Nor shall I flatter myself that I can much augment your stock of knowledge. Mr. Hunter was accustomed to aver, that "he was not so big a fool this year as he was last;" and if we have been as fortunate in this respect as the great physiologist, the honest views and faithful experience of any one of us, on the most common practical topics are worthy of attention. I have endeavored to arrange my thoughts on the subject of *Fracture*; as being one of universal interest to the profession, and not because I have new views to offer, or new practice to recommend. Mr. Abernethy, in his Hunterian lectures before the Royal College of Surgeons, boasted that "he would tell the big wigs how to make a poultice;" and I hope my hearers will not be startled, if I should imitate this celebrated English surgeon, in offering some equally homely, but I trust useful, precepts on an important practical subject.

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* See Note A.

There is a chaos of knowledge on the subject of fracture; and yet, if an inexperienced man were to read the record of it all, his very next case of fractured limb might puzzle him. The varieties of fractures are endless, but the principles which should regulate us in their treatment are few and simple.

*Definition.*—Fracture is "the separation of a bone by violence into two or more parts."* The phenomena which follow this accident vary according to the office of the injured part. When bones constitute a part of the apparatus for the performance of a function, as in locomotion where they are the levers on which the muscular forces act, their solution of continuity necessarily suspends or greatly impedes this function. While, on the other hand, the fracture of bones destined to contain and preserve important organs, as the bones of the head, spine and thorax, may produce destructive injury of these organs, or may take place without in the smallest degree endangering the integrity of the contained parts, or diminishing their capacity to perform their usual office. Instant death *may* follow the fracture of a bone, as where the fractured cranium causes laceration of the cerebral pulp or effusion from torn arteries; or where fracture of the odontoid process of the second cervical vertebra produces compression of the origin of the nerves of the diaphragm and other respiratory muscles. The importance of fracture depends likewise on the part of the bone in which the fracture is found, whether near to or distant from a joint; on its direction, whether

* Young.

transverse or oblique; on the degree of displacement and its cause; on its complication with other injuries of the same bone or neighboring parts; and, finally, on the age and health of the patient.

Bone is formed by the deposite of phosphate of lime by arterial action. This process, and the corresponding one of absorption, continue through life; and their relative activity at different periods of life varies the constituents of bone, and modifies the circumstances of fracture, as well as the rapidity of the restorative processes. In youth, the process of deposition overbalances that of absorption, and the bones grow more and more dense, while if fracture occur, the fibrous tissues still abound to a degree which tends to prevent a separation of the earthy parts, and the fracture is rendered incomplete. In adult life, the equilibrium between absorption and deposit is established, and the density of the bone remains for a time stationary. In old age, the balance is again destroyed, the nutrient arteries are wholly or in part obliterated, the absorbents continue their action, the whole body diminishes in weight, and the bones, especially, grow lighter, thinner and softer, so as to present a mere shell, sometimes capable of being cut with a penknife, which in healthy adult life would make no impression. The prevalence of the softer tissues in infancy gives rise to an injury which is very frequently met with at this time of life, and which requires the same treatment as fracture. This is *bending* of the bones, like whalebone, or rather like the breaking of cornstalk where the fibrous tissues do not give way.

The fragility of bone is sometimes greatly augmented by disease; in which case the softer tissues are absorbed and the earthy particles lose their cohesion. Fabricius Hildanus relates a case of fracture of the fore-arm, caused by the drawing on of a glove!

The disturbance of the constitution, occasioned by the processes of restoration connected with fracture, is usually moderate. But it is far otherwise with the sympathy of the system created by inflammation occurring in large joints. Hence arises the general rule with regard to fractures of the extremities, that they are more important the nearer they approach to the articulating surfaces.

The direction in which a fracture takes place depends mainly on the direction of the force applied to produce the fracture. Oblique fractures are for the most part accompanied with displacement, and with laceration of the surrounding soft parts. The nature of the force applied also determines the nature of the fracture as to the number of fragments, whether simple or comminuted. Notwithstanding the great number of pieces into which a bone may be broken, complete ossific union may unite them all again. This has been known to take place when their number has amounted to twenty. The obliquity of fracture may be so great as to split a bone longitudinally. This no doubt is a very rare accident, although some indubitable instances of it have been recorded.

The displacement between the fractured portions of bone, is occasioned in part by the direction of the force applied to produce the fracture, but mainly by

the action of muscles inserted into the separated portions.* In the bones of the extremities, particularly the lower, the greatest thickness of the muscles being on the posterior and internal aspect of the bones, and their insertions being into the inferior fragment or those parts attached to it, the upper fragment almost invariably overlaps the lower, thereby causing a seeming projection, which disappears when the more movable lower fragment is restored to its original position. It is practically important to know that the efforts at reduction are to be made upon this latter portion which alone is displaced. In transverse fractures, the displacement is less than in the oblique, and in the separation of an epiphysis, which is a fracture of the broadest part of a bone, the displacement is often so little as to allow of the function of the part being still performed.

*Kinds of Displacement.*—Displacement of the fractured portions of bones may take place either by retraction, rotation or twisting, overlapping, flexion or altering the direction of the axis, and by slipping in a lateral direction so that the axis of the two portions does not form a continuous line. The above enumeration of causes may be all combined in a single

* A remarkable proof of this fact is furnished in the case quoted by Breschet from the clinique of Dessault. A patient falling from a height fractured the femur so as to shorten the limb. The next day the shortening of the limb had disappeared, but it was found that he labored under paralysis of the inferior extremities and bladder. By the application of moxa the paralysis was cured, and immediately on the muscles resuming their contractile power the shortening of the limb reappeared.

instance. We will consider these modes of displacement in detail.

I. *Retraction.*—Displacement by retraction takes place when one part of a bone remains fixed and the other portion is left free to move in the direction of the muscular fibres inserted into it. Instances of this are found in fracture of the patella, of the olecranon, of the os calcis, and of the cervix femoris. Indeed it is maintained by some authorities, that the retraction which causes the displacement is the efficient cause of the fracture, and that the fall which usually accompanies the accident is a consequence of the injury, and not, as is commonly admitted, the cause.

II. *Overlapping.*—The displacement by overlapping is a modification of the foregoing. The force with which the muscles act in oblique fractures sometimes occasions a retraction which deeply wounds muscular parts, and even penetrates the skin. It sometimes happens that from the combined action of the muscular forces, and the weight of the body in attempting to use the limb, the pointed bones are thrust through the skin, and even into the substance of adjacent bodies. A seaman was brought under my care, who forty-five days before, while at sea, had fallen from the main-top-sail-yard upon the deck of the vessel, fracturing the humerus obliquely. The superior fragment penetrated the skin, and after ploughing a furrow in the plank half an inch deep and two inches long, was finally broken off in it. On my first visit, this fragment, which was about three inches long, was presented to me, which the captain assured me he had much

difficulty in extracting, two days after the accident, from the plank in which it had buried itself. The final consequences of the accident were, after the patient's recovery, anchylosis of the elbow, shortening of the humerus, partial anchylosis of the shoulder joint, and displacement of the fragment of the fractured scapula.

III. *Rotation.*—The rotation of the lower fragment of a bone upon its axis, is a form of displacement of the utmost consequence to be considered. In fracture of the femur especially, the weight of the foot produces a constant tendency to this displacement, generally by turning outward.

IV. *Flexion.*—The long bones when fractured are liable to form an angle at the place of fracture. This is the most common of all deformities after recovery. The angle thus formed is almost always projecting anteriorly, and is occasioned by the action of muscles which cover the posterior face of the bone. If the inclination of the angle is but slight, it does not retard the cure.

V. *Lateral sliding.*—In transverse fractures, *without* shortening, the fragments are not always in opposition. This is sometimes the effect of the force producing the fracture, and sometimes caused by the action of muscles. The difficulty of counteracting this displacement is much less than in that caused by overlapping.

### CAUSES OF FRACTURE.

Various morbid changes render the bones less capable of resisting the forces which continually act

upon them, as age, rickets, cancer, &c. The principle may be stated generally, that whatever interferes with the nutrition of bone, by which the cohesion of the softer tissues of bone is diminished, becomes a predisponent cause of fracture. The form, length, and office of some of the bones likewise dispose them to this accident.

The efficient causes of fracture arise from force violently applied. This is either *immediate*, as in the case of projectiles, whereby most of the comminuted fractures are occasioned; or by *counter-shock*, as in falls and blows, in which the part that receives the blow is not that of the fracture, which occurs in some more distant part. A sudden force applied in the direction of the axis of a long bone, tends to bring together the extremities of that bone, and the fracture takes place usually in the middle third, where the circumference is least, its density greatest, and its curvature most salient. It is most generally admitted, on good authority, that fracture may take place by the mere action of muscles.

### SYMPTOMS OF FRACTURE.

No one of the physical or sensible signs of fracture is constant. In a bone not much buried in soft parts, and before tumefaction has commenced, the best diagnostic sign is an inequality in the outline of the bone perceptible to the sight and the touch. Next may be accounted crepitation between the fragments, then distortion of form, and, lastly, pain and the loss of voluntary motion. Crepitus is sometimes produced

by the friction of articulating surfaces composing the joints when in a morbid state, or when the synovia is inspissated, and pain, swelling, immobility and distortion may all be symptoms of dislocation and of contusion. On the other hand, when fracture exists, the displacement may be so slight as not to interfere at the time with the function of an organ,—as in the separation of the epiphysis of the tibia, which does not prevent the patient from walking; or so great that the fractured extremities cannot be brought near enough to produce crepitation, as when fracture of the cervix femoris occurs with shortening. A surgeon will not easily be mistaken in fracture of the long bones, who accurately compares their length, their form, and their capacity for voluntary motion; and if to these he adds crepitation when it can be felt, his diagnosis is secure. It should be remembered, that in doubtful cases the patient is safer with an uncertain prognosis, than with a cruel and protracted search for certain proof. And it may be well to caution some over-zealous diagnosticians that when there is no discernible fracture, it is not indispensable to their credit or the patient's recovery, that they should make one.*

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* The learned reader will be reminded that the lash of the Roman satirist was applied to this class of officious observers.

"Lanquebam: sed tu comitatus protinus ad me
Venisti centum, Symmache, discipulis.
Centum me tetigere manus Aquilone gelatæ,
Non habui febrem, Symmache, nunc habeo."

*Martial, 9th epigram, 6th book.*

By taking considerable liberties with the original, the last two lines may be *surgically* rendered thus:

I had no fracture, skilful leech, till you,
By your rude handling, broke the bone in two.

*Prognosis.*—In regard to the prognosis of fracture, danger to life may arise under several circumstances.

I. Fracture may occur in the diseased, the debilitated, or the aged, in whom the vital processes during a state of health are carried on so feebly that they will not bear the additional interruption occasioned by the pain, irritation and confinement of fracture. In the aged, especially, where the organs of circulation have become diseased in their structure, there is danger, lest after a long recumbency, a change to the erect posture should suddenly throw a burden upon the heart too great for its contractile powers, and instant death might ensue. It is a practical caution, worthy of being remembered, not to let the aged, during treatment for surgical accidents, lie too long upon their backs in a horizontal posture, and to bring them gradually to an erect position.

II. In the case of inebriates, the complication with delirium tremens makes even the simplest form of fracture a dangerous disease. I have known the death of such a patient to be occasioned by his uncontrollable efforts to walk during the first week of treatment for an oblique fracture of the tibia. I have known abscess and sphacelation of the soft parts, occasioned by the insane struggles of such a patient to extricate his limb from counter-extending splints.

III. Fractures are more dangerous as they are more complicated with wounds of the soft parts which communicate with the open air. Thus a bone splintered by a shot from firearms is more hazardous than the same degree of comminution would be, if occasioned by crushing the parts without external wound.

IV. Fractures involving the joints are dangerous from the constitutional symptoms which for the most part follow upon inflammation of articular surfaces. Other circumstances being equal, the fracture of bones by direct force is more dangerous than fracture by counter-shock.

As regards the favorable or unfavorable termination of fracture where life is not endangered, non-union, artificial joint, anchylosis, shortening and deformity, are more apt to occur in oblique than in transverse fractures; in those occurring near the joints, especially if complicated with luxation, than in those which take place near the middle of the long bones. The more a bone is surrounded with muscular fibres, the more certain and rapid is its consolidation. The less the injury inflicted upon the periosteum, the more rapidly do the restorative processes go on. Suppuration and gangrene are more apt to follow after comminuted fractures. Finally, the state of the patient's general health and constitutional vigor greatly influences the ossific processes. There are some peculiar constitutions, which, although vigorous enough in all other respects, have an inaptitude to ossific union of broken bones.*

### MODE OF UNION.

*Callus.*—The cicatrization of divided bones is effected by the formation of a new substance called callus, which forms a bond of union between the fragments, at first of a fibrous or fibro-cartilaginous

* See Sir EVERARD HOME'S paper, Transactions of a Society for Medical and Chirurgical Improvement, Vol. I, p. 233.

consistence, but ultimately of a greater density, and containing a larger proportion of earthy constituents than natural bone. In the reproduction of bone, the more dense are more easily regenerated than the spongy. The cranium, after the removal of bone by the trephine, is rarely united by perfect ossification. The first bond of union in fractured bone is the same as in all solutions of continuity by violence in soft parts, viz., the fibrine of the blood. This does not necessarily depend on the extravasation of blood caused by laceration, but is furnished by all the parts concerned in the injury; by the broken ends of bones, by medullary tissue, by the torn periosteum, by the lacerated cellular membrane and muscular fibre. These all pour out either blood or some of its constituents, the serum and coloring particles of which being speedily removed by absorption, the plastic fibrine is left enveloping the injured parts. The phenomena of inflammation now begin to appear in a greater or less degree. Coagulable lymph is thrown out, by which the surrounding bond of union is rendered more adhesive. The periosteum becomes tumefied and very vascular, changes which have caused a much greater agency to be attributed to this membrane in the formation of bone than probably belongs to it. The experiments of Mr. Syme, however (Transactions Royal Society, Edinburgh), put it beyond a doubt that the periosteum can take upon itself the office of secreting bone, independently of the bone itself. For when the periosteum of a bone

of the animal experimented upon, was carefully raised and a plate of metal inserted beneath, a layer of osseous matter was found, after the lapse of a considerable time, covering the metal which was laid between the periosteum and bone, and consisting of a bony deposit in the periosteum. The exudation furnished by all parts in the neighborhood of the broken fragments is at first of a gelatinous consistence. Next, that part which is nearest to the fractured fragments is converted into a fibrous cartilage. While this is going on, the ends of the bones are softened, so that crepitation disappears before union has taken place. If the fragments of bone are not distant from each other, this provisionary exudation surrounds their extremities in one mass or lump; but if there are several portions at considerable distances, each has a separate provision of fibrinous exudation, which may or may not reach the nearest of the other fragments. The medullary cavity of the injured part of the bone is also filled with this same substance. As early as the fifth day from the time of the fracture, red vessels begin to be discovered, proceeding from the surface to the centre of the mass. The vascular organization of this incipient provisionary callus is the source of the ossific deposit by which the bony union is finally established. This tumor of callus, as it is sometimes termed, commences, not from the face of the fractured ends, but from the sound bone at a little distance from the ends of the fragments, forming a casing or ferule around the outside of the parts involved in the fracture, within which mass the rest of the process of union

goes steadily on. The medullary cavity now gradually contracts, and is at length obliterated by a deposit of the same exudation, and a layer of ossification begins to be formed within the cavity of the bone as well as on its exterior, the thickness of each layer gradually increasing till they conjoin. Last of all, the medullary cavity is again restored by absorption, which leaves only some osseous septa. Absorption continues to go on for many months after the parts have become strongly united, until the superfluous parts are wholly trimmed off, and the restored parts approach in form nearly to their original shape. During this last period, the muscular and aponeurotic fibres surrounding the fracture begin to be united to the newly formed bone. After ossific union is completed, there remains a mark which has been compared to the line denoting the union of the epyphysis to the shaft of a long bone.

The natural history of callus has occupied many acute minds, and given rise to numerous theories and experiments. Among the most instructive experiments on the subject, are those of Villermé,* performed upon dogs. From these we learn, that the *first* period, or that of effusion and adhesive inflammation closely embracing the fractured parts, lasts from the first to the sixteenth day. The sharp points of bone begin to soften and round off not before the tenth day.

The *second* period may be reckoned from the sixteenth to the twenty-fifth days, during which the fragments are buried in a sort of knot, consisting of a

* Dictionnaire des Sciences Medicales, art. *Cal.*

fibrous or fibro-cartilaginous mass. During this period, from the seventeenth to the twenty-fourth day, the tumefaction from extravasated blood and lymph, which has involved the surrounding parts in a reddish colored homogeneous mass, begins to lessen from without inwards, and the distinction begins to be defined between the muscles and the subjacent parts. During all of this period the elasticity of the callus allows of correcting by moderate pressure any deviations from a proper direction. It is remarkable how little pressure will suffice to produce great changes in soft bone. An acquaintance with this fact, and a moderate application of ingenuity, might have remedied the deformities in the union of many a fractured bone. Dupuytren was often able to accomplish this as late as a month after the accident. A beautiful illustration of the fact I have mentioned, is witnessed in the operation for harelip, in very early infancy, where the union of the soft parts, by a very gentle traction, causes the cleft portions of the os maxillare superius to approximate and finally to coalesce. Attention to this fact, likewise, will show that it is of more consequence to keep the fragments in exact opposition during the third and fourth weeks, while consolidation is going on, than during the first and second week, while the intermediate deposit is the only substance to be acted upon by motion.

The *third* period is that of ossification, which lasts from the twenty-fifth to the ninetieth day from the accident. The ossific process originates from two places at the same time. One is the external surface

of the fibro-cartilaginous callus whence the calcareous deposit advances inward; the other is the medullary cavity, whence it advances outward. In their progress, the two divisions pass through the intervening space, are identified with each other, and the whole distance is converted into bone. The process much resembles the conversion of cartilage into bone in the sternal cartilages of the aged. If muscular fibres and fragments of membrane are interposed between the fractured extremities of bone, they become speedily absorbed. It is obvious that when bones overlap so that the fractured ends entirely pass the place of the fracture, the process of ossification will be modified. The callus, being thrown out from the uninjured parts of the bone, the central portion or plug furnished from the medullary cavity will be unnecessary and will be found not to exist; and, finally, the soldering together by the callus thrown out is permanent and does not allow of the distinction into provisional and definitive callus. Specimens are preserved in museums, where the junction of the fragments is effected by a bridge of bone, which does not in the least degree involve any part of the bone concerned in the fracture.*

The *fourth* period can hardly be regarded as having any distinct boundary to mark it from the preceding. It is the termination of the process of restoration, by what is termed a definitive callus; for the conversion of the provisionary callus from a fibrous or fibro-cartilaginous consistence to bone, is not the final termin-

* Amesbury, Observations on Fractures.

ation of ossific union. The ossific callus still supports the fragments much in the same manner that the splints applied by the surgeon have done, by embracing the divided parts; while the portion of callus between the fractured extremities, which may be supposed to act as a sort of cement, is capable of supporting but a small degree of violence. For an indefinite period after the firmness of the callus has given as much strength to the bone as it possessed before the fracture, this interposed bond of union is growing more and more dense, till at length its compactness gives it the resemblance of enamel or ivory, rather than bone. When this stage is completed, the bond of union is denominated the definitive callus.

The views which the above-mentioned experiments of Villermé support are essentially those which later writers entertain. As I do not know a subject in surgery on which it is more difficult to obtain clear ideas from reading, than the formation of callus, I shall, even at the risk of being charged with repetition, offer the following as a succinct statement of what is held on the subject by the highest modern authorities.

1. Immediately on the occurrence of a fracture, the minute vessels of every part concerned in the injury begin to furnish either blood, fibrine, or lymph, which constitutes a gelatinous material filling all the vacancies occasioned by laceration, and completely enveloping the portions of bone requiring repair.

2. This intermediate deposit becomes gradually converted into a fibro-cartilaginous bond, in which are early deposited specks of bone, by degrees more and

more multiplied, till a new bony tissue envelops the fragments without and plugs the medullary cavity within. To this bond is applied the name of provisionary callus; and it is to provisionary callus, when it has acquired sufficient firmness, that we trust the use of a limb during the first period after recovery from fracture.

3. Lastly, a portion of this callus, especially that which lies between the fractured extremities, acquires additional hardness, or, as it is termed, becomes eburnated, and the bond of union is the definitive callus. A period of eight months or more is required for the completion of this change, during which the superfluous portions of callus are removed by absorption.

From this account of the formation of callus, it is very obvious, that the exact time of complete union or continuity of osseous tissue between the fragments cannot be determined. For all practical purposes, the time of union may be considered as bounded by that period when the fragments will bear the application of moderate force without causing motion between them, and the patient can begin to suffer the ordinary action of the muscles upon the injured part. Popular belief, sanctioned by the generalization of medical men, has placed the average time of union, in the long bones of the extremities, at forty days. Experiments on animals place it between the twenty-fifth and ninetieth days. I have endeavored to deduce it from a tabular view of all the cases of fracture which have been received into the Massachusetts General Hospital since its foundation.* The difficulty of arriving at

* See Note C.

a knowledge of the necessary facts from these documents is greater than I had supposed. The early records are frequently defective as to the exact day of union, as well as in the particulars of age, &c. Thus, out of 367, the whole number of cases of fracture, but a small proportion could be used for analysis. By adopting the rule of dating the day when union is effected, from the time when union is recorded to be "good," "perfect," patient able "to stand" or "walk," and similar conclusive evidence, I have found that the average period of union, in thirteen cases of simple fracture of clavicle, is 21.15 days. In ten cases of simple fracture of the humerus, the average period of union is 26.50 days. In thirty-five cases of simple fracture of tibia and fibula, the period of union is 35.08 days. In thirty-five cases of simple fracture of femur, the average period of union is 37.62 days, or, dropping one remarkable case, in which the union, from some unknown cause, was protracted to one hundred and eight days, the average for thirty-four cases is 36.25 days.

In regard to the influence of particular circumstances on the time of union of bone, in cases of simple fracture, the following are some of the results of analysis. First, as to age.

1. *Clavicle.*

In seven cases under thirty years of age, the average time of union was 20.85 days. In six cases over thirty years of age, the average time of union was 21.50 days. Average of the whole thirteen cases, 21.15 days.

2. *Humerus.*

In six cases under thirty years of age, the average time of union was 25.16 days. In four cases over thirty years of age, the average time was 28.50 days. Average of the whole ten cases, 26.50 days.

3. *Femur.*

In eighteen cases, thirty years of age and under, the average time of union was 35.88 days. In seventeen cases, upwards of thirty years of age, the average time of union was 43 days, or taking out a remarkable case of union delayed one hundred and eight days, the average time was 36.64 days, while the general average of the whole was 51.29 days, or, omitting the above protracted case, 36.64 days.

4. *Tibia and Fibula.*

In eighteen cases of thirty-one years and under, the average time of union was 32.33 days. In seventeen cases, upwards of thirty-one years of age, the average time was 38.64 days. General average of thirty-five cases, 35.08 days.

5. *Tibia alone.*

In six cases under forty years of age, the average time of union was 23.50 days. In six cases of forty years and upwards, the average time was 31.33 days. General average of twelve cases was 27.41 days.

6. *Fibula alone.*

In eight cases of thirty-two years and under, the average time of union was 22 days. In eight cases

upwards of thirty-two years, the average time was 30.87 days. The general average of sixteen cases was 26.43 days.

7. *Patella.*

In three cases under thirty years of age, the average time of union was 58.33 days. In three cases of thirty years and upwards, the average time was 23.33 days. General average, 58.33 days.

Thus it appears, that in all cases except those of fractured patella, there is a remarkable uniformity as to result in the influence which the age of the patient exerts in fixing the period when union takes place, the average time of union being shortest in the younger class of subjects. In regard to the influence which is exerted by the sex of the patient, the comparatively small proportion of females among the hospital cases does not admit of satisfactory comparison. In five cases of fractured tibia and fibula among females, the average period of union is 29.60 days, nearly three days less than that of the youngest class of the whole number of cases.

In fractures complicated with suppuration, the mode of union differs. In this case, granulations spring up from the osseous tissue, which coalesce and form a nidus for the reception of calcareous deposit, which afterwards proceeds as in cases accompanied only by the adhesive form of inflammation.

TREATMENT.

It is the duty of every good surgeon at all times to wait upon nature, "*Minister natura et interpres est.*"

But more especially is this true of the treatment of fractures, where all that art can do, is to effect the coaptation of divided parts and guard against accidents. The rest is purely a natural process, which receives no aid from art. The story which is told of an insane man under treatment for fracture of a leg by an unskilful surgeon, is an instructive one, and if not true, deserves to be so. Finding that the apparatus which had been over-carefully applied was painful and annoying, he dexterously shifted it to his sound limb, and tearing a hole in his bed, thrust the injured limb among the feathers. The surgeon at his various visits finding every thing properly adjusted, prognosticated a favorable issue, and at the end of thirty days taking off the dressings, exhibited the sound limb perfectly straight and fair, and displaying, as he thought, indubitable evidence in the success of the treatment, to attest to his own skill and knowledge; when, to his astonishment, his patient drew out the other leg, the injured one, from among the feathers, a little crooked to be sure, but equally firm and sound.

The treatment of fracture is the same in principle as that of wounds of soft parts. The injury of the softer textures which enter into the composition of bone, may be so slight, even where the earthy parts of the bone are completely separated, that they may unite again by adhesion, and with so slight an inflammation as to be hardly noticeable. This is perfectly analogous to the union by the first intention of incised wounds, and yet the inexperienced surgeon feels by no means the same confidence in committing the

injured bone to that *vis medicatrix* to which he trusts so implicitly in the simple incised wound. He partakes somewhat of the popular trepidation and hurry to which the fracture of a bone gives rise, and which attributes so much efficacy to the mysterious process of "setting." In the case of incised wounds, no important organ being injured, he examines with care, arranges with deliberation, and adjusts with tenderness and firmness. But let a long bone be broken, and all is bustle and confusion. The examination is hurried, under the idea that delay is dangerous, the extemporaneous dressings are imperfect, applied perhaps with the intention of substituting more complete ones when time will admit. This is all unnecessary precipitancy. There is time enough in every case to dispose of all essential particulars. The bed, the apparatus, the position, may be carefully and accurately regulated, and the chances of success in the treatment of the fracture be none the worse for the necessary delay.

As in the reunion of bones the requisite treatment is purely of an *expectant* character, the surgeon's duty may be said to have been discharged when he has removed all those circumstances which tend to retard the natural operations. This duty presents us a threefold indication.

I. The replacement of the separated fragments.

II. The retaining of them in their proper position till united by bony union.

III. To prevent accidents, and combat symptoms of constitutional disturbance.

IV. Subsequently to the union, the indication arises to remove the injurious consequences resulting from the injury, or from the necessary treatment.

*First indication.*—To replace the separated fragments of bone, we apply a force operating in exactly the opposite direction from that which caused, or that which maintains, the displacement. Besides this, we apply the hand to the place of fracture, to effect a more perfect adjustment of the fragments. It is easy to mark the *tactus eruditus* in these manipulations. No greater difference between skill and clumsiness can be shown, than in the handling of a broken limb. The hand of experience is firm, confident, humane, while resolute, in applying an adequate force; while that which is not directed by competent knowledge is timid, unsteady, torturing to the patient, and leaving its purpose uneffected.

In fractures of the long bones of the extremities, the reduction is effected by extension applied to the inferior fragment, and counter-extension to the trunk of the body. A general rule insisted on in French practice, is not to make the application of the extending power to any part of the fractured bone, but rather to the next bone below. Thus, in fracture of the femur or humerus, the extending force should be affixed to the leg or to the fore-arm. But it is obvious that this rule must often, in its application, conflict with the following, which stands high in English practice, viz., that in effecting the reduction, as well as in maintaining it, the position of the limb is to be so adjusted, that, if it be possible, all those muscles which have

their origin or insertion in the lower fragment should be relaxed by flexion. In general, a great force is not necessary to reduce a fracture, but rather a moderate power, continued for a period long enough to overcome the resistance of the muscles. It is sometimes necessary to weaken the retractive strength of the muscles, by producing syncope and nausea, by means of bloodletting and contrastimulants. In those cases where all the extending force that can be applied fails of effecting a reduction, there can be no doubt that it is most judicious to leave the limb in a flexed position, with a view to diminish the resistance which provoked the muscular fibres to action. In general, this will be found to have subsided after the first twenty-four hours.

*Second indication.*—To procure immobility of the fragments is the means to be relied on to maintain reduction. The first agent to be considered in producing this condition is *position;* and attention to this agent is most frequently neglected. There is no doubt that the great majority of fractures would unite perfectly well without applying apparatus, if the bones could be placed in a position where they would remain perfectly still. The nature of the bed on which the patient is to be placed, deserves a minute attention from the careful surgeon, in order to secure and maintain a favorable position. Where a hair mattrass can be placed on a straw bed, this furnishes the best arrangement. Fresh straw is the next best material, and feathers the worst. In all cases where no proper fracture-bed is provided, it is expedient to place above

the bedstead and beneath the bed a level flooring of boards. The French luxury of thin mattrasses of lightly carded wool, to place above the bed of hair or straw, is almost unknown in this country, but would be a decided domestic improvement, as a substitute for unwholesome feathers. In selecting a bed, a narrow one is preferable to a wide one. The fracture-bed of Mr. Amesbury, a triple inclined plane, is so simple a contrivance, and possesses so many advantages in the treatment of fractures, especially those of the lower extremities, that every practising surgeon would find it worth his while to keep one for the use of his patients.

II. But in most cases of fracture of the extremities, position alone will not maintain the apposition of the fragments. The application of splints to the surface of the injured parts is almost universally necessary. In this application we imitate nature in the process of reparation of fracture, for the callus thrown out around the fragments is a sort of natural splint. Great care is necessary in the adjustment of the artificial support of a broken limb, to prevent motion between the fragments. To make the pressure equal in every part, the inequalities of the limb must first be fitted with soft compresses, and the whole limb where the splints are to be applied, reduced to an even, conical cylinder. I know nothing more convenient for this purpose than carded cotton, or, where only a small quantity is needed, folded compresses of cotton or linen cloth. There is this advantage in using cloth, that it may be applied wet, by which a more

perfect and neat adjustment of the apparatus may be effected. Having used the greatest circumspection in guarding every part from injurious pressure, and having adjusted the fragments satisfactorily, the splints should be suffered to remain untouched for a period of at least twenty days, occasionally fitting the ligatures which confine them. Two sets of splints, an inner and an outer set, are necessary, especially for fractures of the inferior extremity, the outer set performing the office of a fracture-box. The inner splints should be of a light material, moderately flexible, and should extend, when practicable, the whole length of the fractured bone. They should surround the limb as near as may be without touching each other. Straw, whalebone, leather, pasteboard, are materials possessing the requisite properties; but thin strips of wood, with or without a lining of cloth or leather, and scored lengthwise by an incision two-thirds through their thickness, are most convenient and accessible. The outer splints should be two in number, of light, firm, thin boards, a quarter of an inch in thickness for the adult femur, and a little wider than the diameter of the limb. It is *desirable* that these outer splints should extend beyond the articulating extremities of the broken bone; it is *indispensable* that they reach beyond one of these extremities. The mode of applying these outer splints is to roll them into the two extremities of a splint-cloth of firm texture and a little wider than the length of the boards, till they meet in the middle, then unfolding them sufficiently to receive the limb, already fitted with inner splints, they are to be secured

with tapes. The limb thus secured is to be placed in a situation to give the greatest ease to the patient, which will be a moderately flexed one. There is another mode of dressing which has been gaining favor of late, and which presents some important advantages, that may be availed of in suitable cases, although I do not think a general reliance can be placed on starch bandages in all cases even of simple fracture. The following is the mode of applying this, which is called the immovable apparatus. Pasteboard, of the quality used by book-binders for the covers of books, soaked in hot water to a pulpy consistence, is carefully fitted to the limb by turns of a roller-bandage, and constitutes, when dry, a perfect mould of the part. Board-splints in a splint-cloth are to be kept on the outside of the pasteboard till the apparatus becomes nearly dry. A few turns of a roller soaked in common starch are first to be applied to the limb; over this is laid the softened pasteboard, also smeared with common starch, and over all many turns of a starched roller, occasionally laying on more starch with the hand or a brush. Something more than twenty-four hours is required for the drying of this apparatus. When perfectly dry, it constitutes a complete coat of mail for the injured part, and where the swelling and inflammation are moderate, nothing can exceed the comfort and security of this arrangement. In simple fractures of children, it supplies the place of the watchfulness and discretion which otherwise would demand so much of the physician's and nurse's time. Indeed, when there is no inflammation, and the appa-

ratus is perfectly dry and hard, the patient moves himself about without fear, and even bears the weight of the body on the broken limb at the end of a week, although, as no possible advantage can arise from such attempts, they are to be discountenanced. The advantages and disadvantages of this now fashionable mode of treatment may be thus briefly stated:—

ADVANTAGES.

1. The starched apparatus insures the most entire immobility between the fragments.

2. It is not expensive, and is perfectly accessible to private practitioners.

3. It cannot get displaced by the awkwardness or imprudence of the patient, and is therefore peculiarly convenient in infancy.

4. In a much greater number of instances than is the case with any other treatment, it allows of the patient being carried into the open air for exercise in a carriage or otherwise, a circumstance sometimes indispensable to the health of the patient. It allows, likewise, a more speedy removal to those who meet with fractures while absent from home. In fractures of the superior extremities of children, under the application of this apparatus, they may for the most part be trusted at school.

DISADVANTAGES.

1. It requires in its application more skill and judgment as to the degree of pressure which is allowable than any other method. An error of either

more or less than sufficient is likely to defeat the intentions of the application, and there is no mode of remedying defects but by an entire re-application.

2. It allows of no inspection of the parts during cure, and, of course, prevents our guarding against the visible effects of pressure.

3. If applied during a swollen state of a limb, it becomes loose, and entirely unfitted, as soon as the swelling subsides. This tumefaction, in cases of fracture, is very commonly present in the muscular parts, immediately after the accident.

4. There is abundant evidence of most disastrous effects having arisen from its use.* The effects of the too great pressure of the immovable apparatus have been:

*a.* Prevention of the provisional callus, which is found not to be furnished in some cases, where the fragments are too closely pressed together.

*b.* Complete sphacelation of a part or of the whole limb below the compressed part.

*c.* But a more common injury is a painful affection of the nerves, and loss of power in the muscles of the part subjected to pressure, which is only removed after a considerable length of time, so that the inability to use the limb is much more lasting than after the cure by other methods. On the whole, the immovable apparatus, although affording the discreet practitioner with a beautiful mode of treatment for a limited number of cases, can never supersede the use of

* American Journal of Medical Sciences, No. 50, p. 460.

the more generally adopted and safer applications. I have spoken only of the use of common domestic starch to prepare the immovable apparatus; but other glutinous substances can be substituted. The French preparation called dextrine is in common use in hospital practice, and possesses the valuable properties of mixing extemporaneously with cold water, and of drying very speedily.*

III. Position, bandages and splints are not always to be relied upon in securing the requisite contiguity of the fragments. When this is the case, it becomes necessary to have resort to permanent extension of the limb, by which the retractive action of the muscles is subdued. This is one of the most difficult points in the treatment of fractures. The application of this principle is chiefly necessary to the oblique fractures of the inferior extremity. A very moderate force, constantly applied, is less irritating to the muscles than a force to greater extent causing pain. In a properly constructed fracture-bed, the leg being secured over an inclined plane, the weight of the body becomes an extending force. By this arrangement, the benefit of the flexed position can be secured. In this class of fractures, however, the majority of surgeons are in favor of the application of Dessault's splints, or a modification of them, which requires the limb to be kept in a straight position. In hospital practice, the success of this mode of treatment is very striking; but in private practice, the results which I

* See Note B.

have witnessed are far less satisfactory. It must be recollected, that fractures are the accidents to which the poor man—the laborer—is most incident, in whose dwelling we cannot always command the requisite watchful attendance. The injuries produced by long splints extending from the pelvis below the foot, and making pressure on the ramus pubis, and by a laced sock or handkerchief bearing upon the instep, are sometimes very severe, even in those cases in which the apparatus has failed of preventing the shortening of the limb. One of the best modes of counter-extension is that devised by the late Dr. Nathan Smith, of suspending a weight over a pulley to a cord affixed to the lower fragment. In very young subjects this counter-extending force is seldom necessary, as moderate pressure soon overcomes the resistance of muscular contraction.

*Third indication.*—To obviate the accidents occurring during the treatment of fracture, we have several rules to be observed:

1. In all severe cases, complete rest of the whole body should be observed.

2. A full diet, in a previously healthy subject, is never to be allowed; but such restrictions are to be insisted on as will lessen the tendency to local inflammation and febrile excitement.

3. The great majority of simple fractures go on perfectly well with no local application after the first dressing; and it is a very desirable point to leave the first dressings untouched for a fortnight. The incessant dreeping of a broken limb, with what are called

evaporating lotions, is, in most cases, filthy and unnecessary. The alternations of wet and dry produce contractions and expansions of the bandages and compresses, and promote the liability to erysipelas of the skin.

4. When local inflammation is severe, the best remedies are leeches and cataplasms, or warm fomentations. The bandage of strips allows the application of these remedies without disturbing the position of the limb. The depletory effect of cataplasms and fomentations, as accessory to topical bleeding, is not sufficiently valued. The amount of fluid which escapes from the exhalents under their use, is very considerable. They are accessible remedies, even in the humblest private practice.

5. The nervous system is peculiarly apt to be disturbed in fractures, and requires the judicious use of opiates, to lessen its irritability, and subdue the spasmodic contraction of muscles.

*Fourth indication.*—After the consolidation of a fracture, the member is not usually restored to its natural state. Stiffness of the articulations, rigidity and atrophy of muscles, œdema and swellings, are often present in a greater or less degree. A neuralgic affection of branches of nerves which have suffered compression by the dressings, sometimes proves a troublesome and distressing complaint. After the removal of the splints and bandages, the injured part should be suffered to remain at rest for a few days, in order to allow the circulation in the capillaries to resume its natural course. The attempt to use a

fractured limb too soon, is always accompanied with pain and swelling. Fomentations, vapor baths, showering with tepid water, frictions, and passive exercise, will aid in this process. Finally, the articulations recover their freedom by a persevering use of them. In stiffness of the elbow joint, the swinging of a weight in the hand—a practice recommended by Fabricius Hildanus—is worth remembering.

The vast variety of complications which may exist in cases of fracture, cannot be comprehended in one general rule of practice. Excessive contusion,—comminution of the fragments,—open wounds of the soft parts,—injuries of articulations, call for their appropriate treatment, independently of those arrangements adapted solely to the broken bone. The question of amputation, in cases of compound fracture, is one of the gravest that can be offered for our consideration. It is a question which must be referred to sagacity and long experience, the decision of which cannot be reduced to rules. When such a degree of injury of soft parts, crushing of the muscles, laceration of integuments, fascia, and the fibrous tissues of joints takes place as to render sphacelation inevitable, the sooner amputation takes place the better; no time should be wasted in allowing febrile action to be developed in the system. On the other hand, comminuted fractures, with laceration, happening to the young and vigorous, will often tend to a favorable termination, although appearances were at first against it. This is particularly true of those compound comminuted fractures of the superior extremities, caused

by explosions of gunpowder. The experience of many of my audience will doubtless recall instances in which the obstinacy of a patient has preserved a limb, crushed and lacerated in a manner apparently hopeless. In these cases, where the attempt is made to preserve the limb, all straight confinement is to be avoided, the loose fragments are to be removed, the reduction of bones attempted by the most gentle means only; and when these are unsuccessful, the reduction must be postponed till the tumefaction has in part subsided. The part should be covered with a cataplasm of bread and water, and enveloped in oiled silk, or some other impervious substance, to prevent the drying up of the cataplasm. This sort of patient surgery is often blest with a happy result.

In oblique compound fractures, an accident sometimes happens, which requires the interference of art. A pointed extremity of bone makes its way through the skin, and, on making extension, the reduction is opposed by integument, fascia or muscle interposed between the fragments. The obvious rule of practice is to saw off the pointed end of bone, and divide the bands which create the stricture, in the longitudinal direction of the bone. The suppurations which follow these contused fractures are often extensive, and demand great care to provide sufficient counter openings to drain off the deposits of pus, as nothing is more likely to defeat the process of ossification than the constant maceration of the fragments in pus.

Fracture and luxation, without external wound, are sometimes found combined, and occur from the union

of a direct force with counter-shock, or from a succession of blows, operating in different directions. In such cases, the indication of treatment is to secure the fragments from motion till the provisionary callus is strong enough to bear the application of a force sufficient for reduction. This will usually take place in six weeks.*

### NON-UNION.

In a certain proportion of cases, the re-union of bone is not effected. Very rarely does this arise from internal constitutional causes; more generally it is the result of some local circumstances, incompatible with the process of ossification. The state of pregnancy has been regarded as unfavorable to the union of fractures. There can be no doubt that some instances have occurred to favor this opinion. Such cases are recorded by Fabricius Hildanus, and others. But these cases are rather to be regarded in the light of exceptions, than as conforming to the general rule. My own experience, and that of my hearers, will furnish the recollection of many fractures in which a state of gestation produced no obstacle to a regular and perfect union. A scorbutic diathesis is an internal cause which not only hinders the right formation of callus, but, in some instances, during long sea voyages, has been known to occasion a reversed action of vessels, by which union already formed becomes absorbed, and bones, long united, separate. The effect of cancerous, rachitic and syphilitic diseases in

* See Boston Medical and Surgical Journal, Vol. I, 1828–29, p. 12.

preventing union of bones, has, I think, been overrated. I have seen repeated instances of rapid consolidation in bones so diseased as to be broken by a very small degree of force. The ossification of a fracture is sometimes prevented by a foreign body, which keeps up a constant discharge of pus from the part. This is sometimes a detached splinter or exfoliated scale of bone. When this is withdrawn, healthy granulations spring up, and consolidation is speedily effected. The bones of the fore-arm seem to possess some peculiar property, which renders them liable to be the subject of non-union more frequently than the other long bones.

Too great freedom of motion is the common cause of want of union between fractured bones. Too great a distance, also, between the fragments defeats their union. There are, also, certain bones which, from something in their tissue, not well explained, seem to have a natural inaptitude to ossific union. These are the cervix femoris, the patella, the os calcis and the olecranon. The action of muscles attached to these bones is a main cause operating against their coaptation; but even when this is overcome, the bond of union between the fragments is of a fibrous instead of an osseous tissue.

In cases of non-union, the condition of the fragments may be permanently left in either of two conditions, that of artificial joint, properly so called, where the ends of the bones are covered with a cartilaginous deposit and synovial membrane, allowing easy and free motion; or there may be between the ends a

flexible, fibrous band, interspersed with spiculæ of bone. As, in all cases of fracture, inflammation seems to be a process necessary for the effusion of callus, in non-union the principal indication is to produce, in the adjacent parts, the necessary degree of inflammation. Blisters and friction have been resorted to, to rouse the dormant energies of the parts; but the most efficient means has proved to be the passing a seton through the place of unnatural union. It is well known that this practice was first recommended and successfully adopted by the late distinguished Dr. Physick. Of late, an ingenious mode of union, by passing silver wire through a hole bored in the fragments, and twisting it together, has been recommended, and is worthy of trial. But, unfortunately, in the most important of these cases of non-union,—that of the cervix femoris,—no such remedy can be applied, and a hopeless separation of the fragments must be submitted to.

We are now prepared, in some degree, to consider the peculiarities presented by fractures of the different bones, in their causes, symptoms, diagnosis and treatment.

I. *Bones of the Cranium.*—The head is particularly exposed to fracture, both from falling bodies and from falls, in which this part is brought to the ground, or in contact with other bodies. These, as well as all other wounds of the head, are healed more speedily, other things being equal, than wounds in other parts. Fractures of the flat bones require no peculiar treat-

ment, and are only important as they involve injury to the brain and its investing membranes. It is worthy of note, that, by a beautiful provision of nature, callus is not here thrown out, in the work of repair, with the same profusion as in fractures of the extremities. It is obvious that, if such were the case, nearly every fracture of the cranium would be fatal, by the pressure of the dense callus upon the brain. In many solutions of continuity of the flat bones of the cranium, where parts have been removed by the trephine, and otherwise, there is no attempt at ossific union, but a membranous expansion shuts up the opening. By the same causes, the facial bones are liable to be broken, and afford a vast variety of opportunities for the exercise of surgical ingenuity. The proper treatment, in all cases, is to restore the separated bones to their proper contact, and retain them there. I have seen the bones of the entire face, lower jaw and all, broken off from the cranium proper, by a sharp body of great weight falling upon the junction of the nasal bones with the os frontis. Very severe injuries of these bones may be sustained without fatal consequences, unless the fracture extends through the body of the sphenoid bone, or otherwise injures the base of the brain. The lower jaw is much exposed to the causes of fracture. The action of powerful muscles attached to every part of it, tends greatly to displace the fragments; but we have, fortunately, in the situation of the teeth, the best means of counteracting this tendency. A piece of annealed wire can be drawn tightly around the two nearest teeth in the

two fragments, which produces a retentive apparatus as effective as it is simple. Besides this, a pasteboard splint can easily be fitted to the outside.

A wagoner was crushed, by the passing of the wheel of his loaded wagon over the lower jaw. A double fracture was occasioned, and the detached portion of bone, with the tongue, was forced down the throat, so as nearly to occasion suffocation. The accident occurred in the night, but, fortunately, near a house, whose inhabitants were awake; and the patient obtained the loan of an iron spoon, with which he contrived to drag the tongue forward, and prevent the impending suffocation, till I was enabled to secure the fragments by wiring the teeth. Great swelling followed, preventing deglutition for many days; but the patient, being supported through an œsophagus tube, eventually recovered.

II. *Vertebræ.*—The spinal column represents a single long bone, and every sufficient force applied, tending to bring together its two extremities, may cause fracture of one or more vertebræ. In fracture, with displacement of the vertebræ, the symptoms vary with the part of the column injured. If above the fourth cervical vertebræ, as in fracture of the odontoid process, death usually ensues immediately, from compression of the origin of the phrenic nerve, and other nerves, supplying the organs of respiration. If below the third, but still above the origin of the nerves forming the axillary plexus, paralysis ensues in the superior extremities. Paralysis of the lower extremities, of the rectum and bladder, of the muscular coat

of the intestines, producing a tympanitic abdomen, follows upon displacements of lower portions. A man 21 years old fell from a tree, at the height of 15 feet, and struck his head upon the pavement beneath. His head was bent down upon his chest, and the weight of his body brought a strain upon the cervical vertebræ. A severe laceration of his scalp was the most obvious injury; but he constantly asserted that his "neck was broke." I could discover no perceptible crepitus, by the slight movement which I dared to make; and there was, at first, no paralysis. After death, which occurred 22 hours after the accident, three of the cervical vertebræ were found fractured, and their intervertebral substance crushed and comminuted. The remarkable symptoms in the case were the absence of paralysis, till within two hours of death, the undisturbed state of the intellectual functions, and the patient's own consciousness of the real nature of the injury under which he was suffering.

The treatment of fractured vertebræ is limited to producing motionless rest, and obviating the symptoms of inflammation and irritation which may arise, by appropriate means. A proposal has been made from high surgical authority, to cut through the dorsal muscles, and raise depressed portions of bone in fractured vertebræ, which has been acted upon several times unsuccessfully, and is now justly condemned by most judicious practitioners.

III. *Sternum.*—Fractures of the sternum are comparatively rare. Its elasticity and spongy texture, its support, in forming with the ribs part of an elastic

circle, and its dividing the shock of any violence communicated to it, between its several pieces and the cartilages of the ribs, constitute its best defence. Men have been drawn, by machinery, through an aperture incredibly narrow, and yet escaped without fracture, by the operation of these conservative causes. When simple fracture, without displacement, takes place, no serious symptoms are to be apprehended; but comminuted fractures, and those attended with depression, may inflict fatal injury on vital organs within the chest. The trephine is applicable to raise the depressed bone here, as well as in the cranium.

IV. *Ribs.*—The very great strength of the ribs, derived from their form, elasticity, and the elasticity of their cartilaginous extremities, renders their fracture, in early life, not a very common accident. Immense weights have been borne upon the sternum, by strong men, without fracture of the ribs; and the common sports of boys exemplify the great power of resistance possessed by the thorax. But after age has increased their fragility, they are not infrequently fractured by blows and falls. The intercostal muscles balancing each other, tend to prevent lateral displacement of the fragments; and the general distension of the lungs, when inflated, tends to prevent displacement in any other mode.

The middle ribs are most exposed to be broken, as the shoulder and clavicle protect the superior, and the inferior have greater mobility and less length. The ribs are frequently broken in two places, especially when the fracture is caused by a counter-shock. In

the case of an old man, whose body became entangled in machinery, I found eleven ribs broken on one side, and six on the other, each of the latter fractured in two places. The application of a bandage, to prevent the motion in respiration, and the abstraction of blood to relieve the dyspnœa, are the only curative indications. Fractured ribs sometimes unite by lateral contact. This occurs near their posterior extremity, where displacement is sometimes occasioned by the action of the dorsal muscles. In the case of an old man whose ribs had been fractured by the wheel of a chaise passing over him, the union of two contiguous ribs left an opening, through which the integuments were protruded, in the form of a large tumor, by the hydrothorax, which, some years afterwards, caused his death.

V. *Pelvis.*—The thick, strong bones of the pelvis are rarely fractured; and when this accident occurs, it is from a force so violent that the most serious consequences generally follow. The falling of a bank of earth, of heavy bodies used in erecting buildings, being run over by loaded wagons, and the force of projectiles, are the common causes of fracture of these bones, by which extensive contusions of the external soft parts, painful compressions of nerves, and dangerous effusions and lacerations within the pelvis, also, are occasioned. The diagnosis of these fractures is difficult, from the thickness of the surrounding soft parts. The fracture is not always to be looked for in the place of the force applied, but it may be effected by counter-shock, in some other part of the circum-

ference of the pelvis. A blow on the pubes or ilium may cause a fracture of the ischium, or lateral portions of the sacrum. In very severe injuries, it is rather to be looked for that fractures will be found to have taken place both from the direct force and the counter-shock. In the treatment of these accidents, our curative plans are limited to absolute rest, in a position to allow of the greatest relaxation of the muscles, moderate pressure of a bandage round the hips, secured by straps over the shoulders and under the thighs, and moderating by proper treatment the local inflammation and general constitutional disturbance. Mr. Arnott's hydrostatic bed affords a most useful means of promoting the cure, and alleviating distress. The progress of internal abscesses and effusions is to be carefully watched, and an early outlet provided for their discharge, and that of the splinters of bone which may be thrown off. An unfavorable prognosis is justified in the majority of severe cases.

VI. *Scapula.*—Fractures of the shoulder-blade are not common, although more frequent than those of the pelvis. The apophyses and neck of the bone, being more exposed to the contact of opposing bodies, are more frequently broken than the body. The crepitation of the fragments points out the nature of the affection, in almost every instance. The diagnosis is more difficult in case of fracture of the coracoid process, the part being deeply seated, and the contusion and tumefaction around it usually great, as nothing but a strong force, directly applied, will cause this fracture. The fractures of the body of the bone,

which I have seen, have been occasioned by falls upon the elbow, by which the humerus is forced strongly upward, and the scapula gives way about its middle. The only treatment required, is to keep the arm immovably fixed to the trunk, by a simple bandage; and, in fractures of the apophyses, to elevate the elbow sufficiently to retain the fragments in opposition.

VII. *Clavicle.*—From its curved form, its position and its peculiar office, fracture of the clavicle is one of the most common accidents to which the bones are liable. They are exposed to direct causes of fracture, but especially to blows operating by counter-shock. Both clavicles have been broken by the same force pressing together both shoulders, as where the body has been crushed between a wall and a heavy carriage. This is the most common of all fractures in infancy. When a child has fallen from a bed or chair, and complains of pain on moving the superior extremity, especially if the humerus be pressed upwards by a force applied to the elbow, there is strong reason to apprehend a fracture of the clavicle. This is most often accompanied with a perceptible crepitus, on examination, and not always by motion between the fragments. It is quite common, when the most accurate examination has failed to detect crepitus or motion, to find a tumor of callus, of the usual size, on the eighth or tenth day; and I have known a surgeon's reputation materially damaged, by too strong a negative diagnosis in such cases. The only safe rule, in doubtful cases, is to proceed on an affirmative supposition, and apply a simple retentive

apparatus. The only treatment necessary, in fracture of the clavicle, is: 1st. To support the weight of the superior extremity, by a sling below the elbow. 2d. To carry off the superior end of the humerus, by a fulcrum of suitable material, placed in the axilla. 3d. To prevent the shoulder from falling inward, by turns of a bandage carried from the injured to the sound shoulder. A simple and effective method, in those cases where there is little disposition in the shoulder to fall inward, is to apply a graduated cushion between the humerus and trunk, confine the humerus with several turns of a roller round the body, and to suspend the hand and fore-arm in a handkerchief tied round the neck. In adults, where the fracture is in its usual place, the middle of the bone, the diagnosis is easy, by running the fingers along the superficial line of the bone. But when the fracture takes place at the scapular extremity, near the coracoid process, the diagnosis is difficult, and sometimes impossible to be determined by examination; and only to be inferred from the pain, inability to carry the hand to the head, and the nature of the force applied in producing the fracture.

VIII. *Humerus.*—This bone is exposed to fracture principally from the effects of direct force; a counter-shock rather tends to dislocation. Fracture of the middle portion is easily detected; but at its extremities much doubt often accompanies the diagnosis. At the superior extremity, fracture above the insertion of the pectoralis major, or, as it is surgically denominated, fracture of the neck of the humerus, may be easily

confounded with dislocation. There is the same flattening of the shoulder, depression below the acromion, and tumor in the axilla. But in fracture there is greater freedom of motion, the tumor in the axilla is irregular, sometimes angular, instead of being round, and especially, as has been particularly noticed by Dupuytren, the kind of force producing the accident will be found to vary. A direct blow on the deltoid muscle, or a fall with the hands confined by the dress, will cause a fracture of the neck of the bone; while a dislocation is more apt to be occasioned by receiving the force of the blow upon the hand, put out to break the fall. A careful attention should therefore be paid to the marks upon the dress, and to the contusion of the soft parts, with a view of determining the direction of the force applied. Fracture of the inferior extremity of the humerus is perplexing, from the complicated nature of the elbow joint, and the great degree of tumefaction which usually accompanies the accident. The fracture of this part is mostly occasioned by direct force, and consequently is frequently comminuted. Sometimes one condyle is broken off. Sometimes the shaft is broken near the condyles, which are separated by a longitudinal fracture. If the articulating capsule is involved in it, the pain, on motion in the joint, is very severe; and the symptoms which take place subsequently are of a grave character, and require strict rest and local depletion. The deposit of callus in the joint is apt to interfere with its motions. In this case, after perfect union of the separated parts has been accomplished, the practice recommended by

Hildanus, of swinging a weight in the hand, has been found very efficacious in promoting the absorption of superfluous callus. An angular splint is proper for these cases; so that if anchylosis should in any event take place, the arm may not be left in an extended posture, which would be far more inconvenient than a state of flexion.

IX. *Radius and Ulna.*—An almost endless variety takes place in the fractures of the fore-arm. One or both bones may be broken, and in one or more places. The middle and lower portion is most subject to the accident, the thick muscles of the upper portion supporting and defending the bones. By a direct force, such as the falling of heavy bodies, the comminuted fracture is produced; while, by a counter-shock, such as falling upon the hands, the simple fractures are, for the most part, produced. There is no difficulty in detecting fracture of the middle of the fore-arm. The altered form, crepitation between the fragments, and the great pain produced by attempting pronation and supination, reveal the nature of the accident. But fracture near the humerus is sometimes obscurely felt, by reason of the thick covering of muscles, and the absence of distortion and crepitation; while fracture near the carpus may be mistaken for luxation. The deformity produced by the latter accident yields readily to extension, and rotation during extension generally detects the former, by producing crepitus.

Fractures of the radius are more common than those of the ulna. When an individual falls forward upon his hands, the radius receives the opposing

forces transmitted by the humerus and the bones of the carpus, and gives way usually in its middle third. The diagnosis is made by feeling for the head of the radius, and gently rotating the hand, by which the solution of continuity will be detected by the motion not being communicated to the superior fragment, or by a crepitation between the fragments. Fracture of the ulna is usually obvious by the prominence of the inferior extremity of the superior fragment, the other being drawn in towards the radius by the quadratus muscle. Whether one or both bones be broken, the tendency of the fragments, owing to their connection by the inter-osseous ligament, and the action of the quadratus and other pronator muscles, is to approach each other and diminish the breadth of the fore-arm. The only means we have of counteracting this tendency is by moderate pressure, by which the muscles are forced between the bones, and tend to separate them. The coaptation of the fragments in fractures of the fore-arm is best effected by committing the extension to attendants, while the operator presses his fingers with moderate force against the inside of the fore-arm, carrying the muscles, as much as practicable, between the radius and ulna. Graduated compresses, soaked in water, are then to be applied, and confined with a roller, over which are to be placed two splints; the inner one reaching from the bends of the fingers to the bend of the elbow, and the outer one extending beyond the external condyle of the humerus. Notwithstanding the greatest care in the adjustment and treatment of fractures of the fore-arm,

many instances of deformity will occur. Our pathological museums present an immense variety of irregular consolidations of the radius and ulna, which must have seriously interfered, during life, with their appropriate functions. From thirty to forty days usually suffices for the union of the bones of the fore-arm; but when the articulations are involved in the inflammation attending the injury, a rigidity and painful increase of sensibility remain for a long time, and require much care and attention. The rigidity of the tendons is to be overcome by the early trial of gentle flexion and extension; and the pain and morbid sensibility by topical bleeding, and especially by warm fomentations and showering of tepid water. The fracture of the olecranon apophysis exhibits some peculiar features. The superior fragment is drawn upwards by the powerful action of the triceps brachialis, leaving a depression between the fragments, by which the nature of the injury may be detected, unless when extensive contusion and injury of soft parts obscures the diagnosis. The accident is produced most commonly by a fall on the point of the elbow, and is accompanied by a sudden and very perceptible snap, followed by pain in the part, and inability to bend the elbow. The reduction is easily effected by the most obvious means. The superior fragment is to be pushed down, and retained as near its place as possible, by compresses and a bandage which should begin at the hand. An angular splint, allowing the fore-arm to be slightly flexed, is to be secured at the inside of the limb. In the great majority of instances,

the union is of a fibrous character; but this does not seriously impair the strength or mobility of the part. The other fractures of the superior extremity do not call for particular description or remark.

X. *Femur.*—The thigh bone—the strongest, most dense, and most completely defended by muscular substance of all the long bones—is, from its length, its position, and especially from its curvature, the most frequently fractured. The fracture is most commonly oblique, and the inferior fragment is drawn upward by the strong muscles attached to it, and to the bones of the pelvis, and rides over the superior, which retains its place. The weight of the leg and foot, and the position in which the foot is attached to the leg, tend to drag the inferior fragments to an angle with the superior, and to rotate it upon its axis. Hence arises a deformity at the place of fracture, which renders the diagnosis of fracture in the shaft of the femur comparatively easy. The bone is usually shortened, bent, and the foot and lower fragments rotated inward or outward. The usual symptoms of pain, crepitus and immobility, may also be commonly observed. The femur differs from every other long bone in the peculiar nature of its superior articulating surface. The transverse direction, and smaller diameter of its neck, render this part peculiarly exposed to the effect of opposing forces compressing together the two extremities of the bone; and the immense power of the glutei, and other muscles inserted into the great trochanter and its neighborhood, separate the fragments, so as to create a formidable obstacle to their

reunion. The thigh bone has been, almost literally, a *bone* of contention for surgeons, and has caused the shedding of more ink, in support of the different views of pathology and treatment, entertained by different eminent surgeons, than any other subject since the discovery of the circulation of the blood. The cautious practitioner, however, will be eclectic in his practice, and adapt his treatment to the nature of each particular case, and not exclusively confine himself to the rules of one master. It is obvious that the private practitioner must choose his mode of practice not only with reference to the kind of fracture, and its place, but also take into view the character and circumstances of his patient, the degree of skill and watchfulness of his attendants, and likewise his own opportunities of frequent inspection.

Some of the arrangements for the treatment of fractured femur are well adapted and useful, but apt to be disturbed by slight causes, and had better be given up for inferior substitutes less easily deranged. There are three modes of treating fracture of the shaft of the femur, each of which has advocates of high authority. The most ancient is that on which Dessault engrafted his improvements. Its principle consists in keeping the limb extended in a straight line. The French surgeons contend for this mode, and it is much used in this country. It is adopted in most cases treated in the Massachusetts General Hospital, where its success will bear a favorable comparison with any other method. The English surgeons, following Pott, till within a few years, almost exclu-

sively adopted the method strenuously recommended by that distinguished surgeon, of laying the limb on the external surface, with the knee flexed. The third method is that recommended by Sir Astley Cooper, and by many modern English surgeons, of laying the patient on his back, and passing the limb over a double inclined plane, the angle of which is placed beneath the knee joint. I am certain there is no one of my audience, who has seen much of private practice, who has not had occasion to adopt all three of these methods. When the fracture is in the upper third of the limb, it is very obvious that the lower fragment constitutes a longer lever, by which the power of displacement is very much augmented in the lower fragment, and therefore the limb, resting on its side, without confinement, is less secure, and more exposed to accident. In this case, the advantages of the straight position are most manifest, as it enables the surgeon not only to compress the muscles, and confine their action, but to keep up a constant application of extending forces, by which the action of these muscles is effectually opposed. Some of these advantages may be had, although not in the same degree, by the use of the double inclined plane. On the other hand, when the fracture is near the knee joint, the perfect relaxation of the muscles inserted into the tibia and patella, and which tend to draw up the lower fragment, is a point of the utmost consequence, and is best secured by laying the limb on its side, in a flexed position. In all these methods, the limb is first enveloped by a bandage of strips, or a

roller extending from the toes to the hips. In the next place, four splints, protected by simple compresses, are to be placed round the place of fracture, and confined with tapes. The immovable apparatus is as applicable to this as to any other fracture, and, in cases of simple fracture without considerable tumefaction, works admirably. For the extended position of the limb, the apparatus best adapted to the management of the case is a modification of Dessault's, in use at the Massachusetts General Hospital. It consists of two splints of hard wood, reaching from below the foot to the groin and the crest of the ilium, and confined at the bottom by a cross-bar, through which traverses a screw; which, by means of a laced sock, or handkerchief applied to the foot, creates the extending force to draw down the limb. A broad belt round the hips, having a pocket to receive the superior extremity of the outer splints, and a strap passing between the thighs, confines the upper part of the outer splint. Great attention is necessary to prevent the injury which may occur from the pressure of the laced sock or handkerchief. In fractures of the upper third of the femur, where the double inclined plane is preferred, the most convenient apparatus by far is Mr. Amesbury's fracture-bed. This effectually answers every indication.

XI. *Cervix Femoris.*—The fracture of the cervix femoris presents considerations of a distinct nature. Deeply imbedded in muscles, the fracture of the part does not exhibit those changes of outline which mark the solution of continuity in the shaft of the bone.

Shortening of the limb—the most apparent physical sign of the accident—is not always present; and if present, frequently does not take place till after several hours, and perhaps days, have elapsed.

*Causes.*—The efficient cause is a force applied to the inferior extremity of the femur, or to the great trochanter. The operation of direct force, as in the case of a projectile, is a possible, but an extremely rare, occurrence. The largest number of cases occur from falls upon the hip. Dessault states that twenty-four out of thirty cases are caused by this accident. An apparently slight force is sufficient to cause this fracture. Among the most common accidents causing it, is slipping from the side-walk into the street, and tripping on a fold of carpet within doors. The predisponent causes are the alterations of the bone by age, which are: 1st. Change of the obliquity of the neck of the femur, by which the force applied, in falling upon the foot and knee, operates more transversely. 2d. An increased deposit of the earthy material of the osseous tissue. 3d. In atrophy of bones, which is by far the most important of these changes. This shows itself by diminution in weight and density, without corresponding diminution of volume. The cavity of the long bones increases in diameter; their walls grow thinner, and the medullary substance abounds. The operation of these changes, in affecting the proportion of fractures of the cervix to those of other parts of the femur, is illustrated by the remark of Cruveilhier, that in four years' service in that great asylum of the aged poor,—the Salpetriere, at Paris,

—where a month was never known to pass, without the occurrence of fracture of the cervix femoris, he had never witnessed the occurrence of any other kind of fracture.* At least two-thirds of the cases of fracture of the neck of the femur occur to females; and this, no doubt, from their being exposed, in a much greater degree than males, to the predisponent causes. Aged females are more sedentary; and hence their greater proneness to atrophy in the organs of locomotion. The form of the pelvis, likewise, in females, creates a more decided prominence of the great trochanter.

*Symptoms.*—When a person of fifty years and upward has received a fall upon the hip, or a shock from stepping down suddenly and unexpectedly from a high step, and complains of having felt, at the moment, a sharp pain in the hip-joint, accompanied with a snap, and is unable to raise the limb without great pain, there is great reason to look for fracture of the cervix femoris. If we look for farther signs, we find shortening of the limb, but not always at the time of the accident; the great trochanter carried outward, and brought nearer to the crista ilii, the knee slightly flexed, and the foot everted. In sixty cases in the observation of Cloquet, the toe was turned outward; and Boyer's immense experience never met with a case turned inward. If the patient is made to stand up, the toes rest upon the ground, while the heel is raised and brought against the hollow of the other foot. On placing the hand upon the

* Livraison, XXIII.

great trochanter, and rotating the injured limb, the trochanter is found to revolve upon the axis of the femur, and not upon a radius formed by the neck of the bone. This diagnostic sign is of great value, and especially observable in those cases where the fracture is at the base of the neck, near the great trochanter. The part of the neck most frequently the subject of fracture, is just at the junction of the head and neck of the bone, where the diameter of the bone, and the compactness of its tissue, are least. In the fracture of this part, crepitus is a less certain sign than in other fractures. When the fracture is very near the head of the bone, the small portion of bone remaining in the acetabulum follows the motions of the major part, and the broken surfaces are not opposed with sufficient force to produce crepitus. So, when the fragments are wedged and impacted together by a blow on the trochanter, motion is communicated to the head of the bone, without crepitus. When, therefore, on drawing down the injured limb to the same length as the other, and gently rotating it, and then performing the same evolution with the limb flexed on the trunk, a crepitus is not perceived, no farther attempts to produce this sensation should be persisted in; especially since such attempts, if rudely continued, may cause the separation of those unbroken fibres of the articulating envelope, or fibrous periosteum of the neck of the femur, which constitute the bands on which the strength of the false articulation greatly depends, and the rupture of which would infallibly greatly increase the degree of eventual lameness. In

the greater number of those instances which have fallen under my observation, no crepitus was discovered by any attempts which I thought it judicious to make. A correct diagnosis, important though it be, is not a paramount consideration; and no very great injury would result from the treatment of all doubtful cases of contusion and injury of the hip, on the supposition of a fractured cervix femoris, judging merely from the presumptive signs. Sir Astley Cooper has been most successful in calling the attention of the profession to the important distinction between the fractures of the cervix femoris which are within, and those which are without the capsular ligament of the joint. The latter, like all other fractures and wounds attended with separation of parts, goes through with a process of restoration and union, in which the surrounding parts assist, and, of course, are not unlike other fractures in their termination; while the fractures within the articulating capsule very seldom unite by ossification or definitive callus, but by cicatrization or fibrous ligament. Sir Astley Cooper, although he does not deny the possibility of this ossific union, affirms in his work that he has never seen an indubitable case. He has been misrepresented as saying that ossific union is impossible in intra-capsular fracture. He has given rise to this misrepresentation by the strength of his language, which his later experience, no doubt, would lead him to modify. I have seen, in his possession, an indubitable specimen of ossific union, and have heard him admit that such cases had occurred to others, although, at the time of

publishing his great work on fractures and dislocations, he had never met with such an instance. My friend, Dr. Mussey, has, with great pains, procured at least two specimens from cases occurring within his own practice, where the evidence of ossific union is indubitable. The question so long agitated may, therefore, be considered as settled in the affirmative, that there is nothing in the anatomical structure or peculiar organization of the parts concerned in this fracture, to prohibit ossific union; but that, under favorable circumstances, it will take place. The reasons why this ossific union so seldom takes place, are, according to Sir Astley,—1st. The non-apposition of the fragments. 2d. The absence of pressure to approximate the fragments, and excite their action. There are no muscular fibres to produce this pressure; and the accumulation of synovia prevents it by interposing between the fragments. To be sure, this effused synovial fluid is absorbed, but not until the inflammatory action, which, in other fractures, produces the provisionary callus, has ceased; and, in its stead, there is formed, from the articular synovial membrane itself, a ligamentous substance, which is to become the bond of union between the divided parts. 3d. The absence of all attempt at ossification on the part of that portion of bone which remains in the acetabulum, and whose vitality is mainly supported by the low vascularity of the round ligament. The ingenious Cruveilhier,* in his magnificent work on the pathology of the human system, combats this explanation, although he goes

* Livraison, XXIII.

even farther than Sir Astley in denying that intra-capsular fractures, when the periosteum and duplicature of the synovial membrane have been divided, can ever unite by ossific deposit. He replies to the first reason, that, in many fractures, the fragments are farther removed from each other, and yet unite by a bridge of bone, which sometimes is connected with parts that are not involved in the solution of continuity; as when a long bone overlaps so far as to have every portion of the fractured fragments pass each other. 2d. As to the second reason, supposing it proved (which is not granted), that pressure is necessary to ossific consolidation, it must, of necessity, exist, by the structure of the capsular ligament of the hip joint, which confines the fragments by its resistance, and prevents any considerable accumulation of fluid, beyond the ordinary quantity of synovia. 3d. The third reason is not satisfactory to this author, inasmuch as his theory of the formation of callus does not attribute an active agency to the fragments of bone themselves, but mainly to the muscles which surround and are attached to them. He supposes that he has proved, by experiment on animals, that the process of union in broken bone is carried on, not by the ends of the broken bone, but by the periosteum and muscles which environ them. At first, these tissues, losing their linear and lamellated structure, assume an appearance like the effusion of albuminous fluid in cellular membrane; then it acquires the consistence of cartilage, and its boundary is defined, separating it from the unchanged tissues; lastly, this

cartilage is penetrated with osseous deposit. In his opinion, it is doubtful if the effused fluids have any office in the formation of callus; and he considers the definitive callus not to be furnished (as Dupuytren, whose theory is a modification of Duhamel's, supposes) by the ends of the broken bones, but to be only the provisional callus, converted from a spongy tissue to a compact one, by interstitial bony deposit. Such being his theory of the restorative process, he accounts for the non-union of intra-capsular fracture of the cervix femoris by the absence of the conditions necessary for the formation of callus, especially by the absence of muscular fibre, attached to the fragments. It is of considerable importance, in a practical point of view, to determine whether the fracture exist within or without the capsular ligament. In the former case, the shortening of the limb is less than in the latter. This is owing to the confinement caused by the capsular ligament, which will only allow of a limited retraction. When the shortening, therefore, is more than an inch, the presumption is, that the fracture is wholly or in part extra-capsular.

*Treatment.*—The treatment of this accident does not, in all cases, present the same therapeutic indications. In very aged persons, the consolidation of the fracture is not the most important indication. Many of these cases prove fatal, in consequence of the injury which the constitution receives from the accident, and the subsequent confinement; and the principal indication is to guard against these disastrous effects. When a physician is called to manage this accident

in an aged person, he should ponder well the consequences of a long confinement in a recumbent posture. The arterial circulation, in many aged persons, is exceedingly laborious; and the disposition to venous congestion is great. From the derangement of the circulation, occasioned by these causes, a sudden change from the recumbent to the erect posture has thrown such a load upon the central organ of circulation as to master its powers, and cause instant death. In such cases, likewise, the skin does not well bear pressure; and tedious and sometimes dangerous ulcerations, over the sacrum, will ensue. In all cases in which confinement to the bed becomes necessary for an aged person, in consequence of injury, it is a good practice to protect the skin of those parts on which the weight of the body rests, by a covering of mild adhesive plaster, such as the Emplastrum Plumbi. In many instances, therefore, a practitioner, carefully weighing all the circumstances, would decide that the case might be left entirely to the operations of nature, without attempting to call in the aid of art. In such cases, the advice of Sir Astley Cooper, for the treatment of intra-capsular fracture, may safely be followed. He avoids confinement and continued extension, as injurious to the general health, and hopeless, as regards union. The patient is to be made as comfortable, as to position, as he can be, by pillows and compresses, and the fracture left to its fate. After a fortnight or three weeks, the patient is to be raised into a chair; and, as soon as able, to begin to use crutches. The following instance,

occurring in my practice, is such an one as is, no doubt, familiar to the observation of most of my audience. A woman, over 70 years of age, who had been accustomed to hardship all her life, fell down stairs, and, striking on the hip, fractured the neck of the femur. She laid upon the bed she had been accustomed to, for four weeks, keeping the part wetted with rum. At the end of this time, she was able to sit up; in six weeks to move with crutches, and in three months to walk without them, with only a slight limp, and the limb shortened one inch and a half. During all this period, her health was uninjured. Every one must have observed how subject aged people are to pains of the large joints. This affection is greatly increased during confinement for the cure of fracture, and constitutes an important argument against the retentive arrangements, whose object is to procure ossific union. The authority of Dupuytren goes strongly for attempting the cure by a longer confinement than is usually practised. Mr. Amesbury, likewise, who places great confidence in retentive apparatus, contends that no case of fracture of the cervix femoris is to be abandoned to non-union until after the employment, for a reasonable time, of the means profitable to effect union. M. Dupuytren believes the principal peculiarity of this form of fracture to consist in the slowness of union, from the imperfect circulation, and the direction of the fracture being nearer to a parallel with the axis of the body, than those of the shaft of the bone, whereby the weight of the body in the erect position easily

separates the fragments. But the long horizontal confinement which this most distinguished surgeon recommends,—from four to six months in duration,—is almost entirely incompatible with the debility of advanced age; and the humane surgeon is called upon, in such cases, to give up the pride of art, and surrender to the patient, tottering upon life's verge, his other comforts, while he abandons the prospect of restoring his perfect locomotive powers. It is, however, a sound rule of practice, to keep the limb quiet, and the fragments in as complete apposition as can be done, without the application of means decidedly injurious to health; for, however the union may be effected, whether by bone or fibrous tissue, the lameness after cure will be less, the nearer the fragments approximate.

When it is considered prudent to aim at ossific union, the indications are, to oppose to the muscles whose contraction draws up and everts the limb,—as the glutei, adductors, pectineus and psoas,—a counteracting force sufficient to overcome their power, and to continue this force during a period long enough for the consolidation of the bone. The variety of the means adapted to fulfil these indications proclaims their insufficiency. The most effectual are the modified splints of Dessault, already alluded to as in use at the Massachusetts General Hospital; and the fracture-bed of Mr. Amesbury. The former apparatus is well adapted for extra-capsular fractures; and, if judiciously managed (for it requires constant watchfulness), can be borne for the period necessary for

consolidation. The latter supports the whole body in an admirable manner, and avoids the danger arising from long recumbency, by enabling the occupant to obtain frequent changes of posture from less to more erect, and the reverse, without discomposing the injured parts. One of the greatest merits of this apparatus is, that the weight of the body and of the limb antagonize each other; and when the foot is confined at the bottom of the bed, this degree of extension will generally be sufficient to overcome the resistance of the muscles. Whatever apparatus is applied, a firm, broad bandage round the pelvis, pressing the fragments moderately together, should never be omitted. Various other plans are described in the writings of surgeons of all countries; but most private practitioners with us will, I think, coincide with me in the judgment I have given.

Fractures of the great trochanter and of the condyles need not detain us, as the general principles laid down for the diagnosis and treatment of fractures in general, sufficiently indicate their management.

XII. *Patella.*—The small size and great mobility of the knee-pan save it from frequent fracture, to the causes of which it is abundantly exposed. When this fracture takes place, it is owing either to direct force, as by falls and blows, or to the powerful contraction of the extensor muscles of the thigh, as in the effort to recover from a fall, in kicking a foot-ball, &c. It is easy, for the most part, to detect this fracture, by the separation of the fragments, which uniformly takes place when the fracture is transverse; longitudinal fracture of this bone being exceedingly rare. At the

moment of the fracture, a sharp pain is felt in the front of the knee, and the patient immediately falls, or, if fallen, is unable to rise on the injured limb. He is unable to walk, in consequence of inability to antagonize the flexor muscles of the leg. These symptoms, however, are common to this, and another accident of much more rare occurrence, viz., rupture of the tendon of the patella, or of the rectus femoris. The displacement of fragments is, however, sufficiently distinctive.

*Treatment.*—In the treatment of fractured patella, the fragments are usually easily brought in contact by raising the heel, so as to extend the limb, and flexing the trunk of the body on the lower extremities. Whatever be the mode of treatment, the union is, for the most part, of a fibrous character; simply because the difficulty of retaining the fragments in sufficiently close apposition for osseous union is so great. If the length of this fibrous union is not too great, the injury is perfectly recovered from, and no observable limp in gait ensues. A great variety of machinery has been put in use, to keep together the fragments of the broken patella; and, as usually is the case, the simplest is the best. The superior fragment, being pressed down, should be retained there by the pressure of a quilted strap passed above it, and secured to a long splint on the posterior part of the limb. If the splint is hollowed, and well padded, and the superior strap fastened to knobs in its side, and crossed by a similar one carried below the lower fragment, and secured to knobs above the former, perhaps no better apparatus can be named. Sir Astley Cooper's is very simple. It consists only of a padded strap secured round the

thigh above the fracture, and confined down by a strap like a stirrup passing below the foot. About six weeks is necessary for the consolidation of this fracture.

XIII. *Tibia and Fibula.*—Perhaps there is no form of fracture to which the surgeon's attention is so frequently called, as to fracture of the leg. Of 367 fractures on the records of the Massachusetts General Hospital, 153 are fractures of the leg. Most of the occupations of laboring men expose them to this accident. Both bones are more frequently fractured than either of them singly; and the most common seat of the fracture is at the superior part of the inferior third of the limb. The tibia is more frequently the subject of fracture than the fibula. At first sight, this may seem unlike what was to be expected. But it is to be observed that the tibia bears the whole weight of the body, and that the articulating surfaces of the fibula are on its side, and not upon its extremities. When the tibia has given way, the weight of the body falling on the fibula would almost inevitably break that bone. I had occasion to remove a leg for compound fracture under the following circumstances: A man, 50 years of age, in good health, while at work in the woods with a very sharp axe, struck at a small twig, which afforded scarcely any resistance to the blow; and the handle of his axe, encountering the limb of a tree, gave a direction to the instrument which brought it obliquely against the tibia, which it divided with a clean cut. Perceiving he was wounded, the man ran a few steps, when the fibula gave way, the lower extremity penetrated through the skin, and he fell. When, however, the fibula retains its continuity,

it furnishes the most perfect splint to retain the broken fragments of the tibia in their proper places. When the fibula alone is fractured near the ankle-joint, the tibia does not so well perform the office of a splint; for the outer defence of the articulation is taken away, and the joint is easily dislocated outward, carrying with the foot the lower fragment of the fibula. When both bones are broken near the ankle-joint, the foot and lower fragments are drawn outward and backward, in a way that somewhat resembles the dislocation of the tibia from the astragalus, with fracture of the fibula. It is to be remarked, that there are no insertions of muscles into the inferior extremities of the bones of the leg, the fibres of which, as in other fractures, might serve to retain the divided portions in partial contact. The foot and lower fragments are displaced by the gastrocnemii and peroneal muscles; and the broken extremity of the tibia projects in a manner not greatly unlike its appearance when dislocated. When fracture exists, compounded with luxation and laceration of the integuments, the accident is one of the gravest that can happen. There is, generally, but little perplexity in the diagnosis of fractures of both bones of the leg. There is sudden pain, inability to walk, deformity in the outline of the limb, mobility of the fragments, and crepitus. It happens not unfrequently that the two bones are not fractured in the same horizontal line with each other. When this is the case, for the most part, the fracture of the fibula is higher up than that of the tibia, and cannot be recognized by the touch. It may always, however, be inferred, when the mobility

of the lower fragment is very great, and the deformity in the outline of the tibia very marked; symptoms that are not remarked when the tibia alone is fractured.

*Treatment.*—In the greatest number of instances, the treatment of fracture of the leg requires only dressing of great simplicity. It is very rarely the case that permanent counter-extension is necessary to retain the fragments in place; and when it is, the simplified apparatus of Dessault is all that is required. If the patient is laid on his back, and the limb well supported by pillows, no harm is likely to follow the delay of two or three days in applying the usual dressings; so that no excuse can be allowed for hurry, and imperfect apparatus. In many instances, the immovable apparatus is well adapted to fulfil the indications of cure. To apply this, two moderately thick compresses, soaked in the solution of starch or dextrine, should be applied to each side of the limb, barely touching each other on the posterior and inferior part, but leaving a small open space in front. These are to be secured by a long roller, soaked in the same liquid, enveloping the whole limb, from the toes to the knee. Then two pasteboard splints, narrower at bottom than at top, are to be applied, after having been made perfectly soft by being soaked in hot water. Over these are to be passed many turns of a starched roller. The whole is to be kept steady by the support of pillows, or of thin board splints, rolled in a splint-cloth. The shrinking of the limb, from the diminished swelling, may require a reapplication of the dressings at the end of about ten days; and it is better to reapply it than to attempt to

fill the vacuities by stuffing with cloth or cotton. Where the immovable apparatus is not applied, the following method has been found satisfactory in every case of simple fracture of the leg which has come under my observation. The patient should first be placed upon a firm bed,—either a mattrass of curled hair, or a feather bed supported on a straw pallet, with a flooring of boards laid on the bedstead. A pillow should be provided for the limb. This is best, likewise, to be made of hair. A softer one may be laid beneath the thigh and ham. Over this pillow are to be laid, first, three tapes, at equal distances; then, two splints of thin board, about four inches wide, and reaching above the patella and below the os calcis. These should be rolled in a splint-cloth, of a suitable width entirely to conceal them, and brought so near together that, when lifted up on their edges, they constitute a fracture-box, just capable of holding the limb, and its interior dressing. Next in order, upon these splints, are to be laid three more tapes; then, two splints of smaller size, reaching from the bottom of the foot to a sufficient height to pass the fracture by several inches. These splints may be scored and lined with soft leather, in the usual fashion. Above these inner splints is to be placed a bandage of strips, upon which are laid three compresses of old linen or cotton cloth, of sufficient thickness, and suitably graduated to fill up the inequalities of the limb, and completely protect the outer and inner ankle from the pressure of the splints, and the os calcis from that of the weight of the limb. The compresses and bandage of strips should be wetted in cold water, and laid

perfectly smooth. The patient being undressed, and laid upon his back on the bed, the limb may be committed to two assistants, while the principal takes charge of the pillow of dressings. The assistants, grasping the limb by the knee and the instep, are to make steady and gradual extension, till the irregularities in the outline of the tibia disappear, and the direction of the foot becomes natural. If the force is skilfully applied, a very strong extension may be made without considerable pain. The pillow of dressings is now to be placed beneath the limb, which is to be lowered down to it, the extension being still continued till the dressings are applied. The compresses, the bandages of strips, and the inner splints are to be adjusted with moderate firmness; and over all, the outer splints and splint-cloth, constituting the most complete and convenient fracture-box. A foot-board is to be adjusted to the bed; a pillow or cushion is to be placed between that and the bottom of the foot, which is to be kept from turning inward or outward by the support of pillows or cushions on the sides. Over all is to be placed a cradle, to bear the weight of the bed-clothes. These dressings may be continued for four weeks, occasionally drawing the tapes tighter, or loosening them, as need may be. The dressings may be opened, and the anterior part of the limb inspected, without the slightest fear of derangement of the fractured portions. In case of compound fracture, likewise, this apparatus gives access to the wound, and portions of it, as the strips and compresses may be changed without disturbing the remainder. When the wound is on the posterior part of the leg,—

which is rare, unless produced by direct force,—the limb may be flexed and laid on the side. For a vast majority of fractures of the leg, the above-described apparatus, methodically applied, will fulfil every indication. When the fracture is very oblique, with a tendency to shortening, the same methods of counter-extension are applicable as have been recommended for fractures of the femur. It has been advised to apply a sort of counter-extending splint (Hutchinson's), the superior extremities of which are confined by a circular strap just below the knee. As far as my experience in their use extends, I have found them create far greater pain and irritation than when the point of support is made at the groin and pelvis. There is one description of cases in which Mr. Amesbury's ingenious apparatus becomes very valuable. By his contrivance,—for a description of which I refer to his book on fractures and dislocations,—a patient can take the air, either with or without a carriage, and thereby the state of the general health be preserved or restored,—the low state of which has sometimes proved the obstacle to ossific union.

Fractures of the lower third of the fibula require a peculiar treatment. The mismanagement of this fracture is a fertile source of deformity. The office of the lower extremity of the fibula is to constitute the outer edge of the mortice of the ankle joint. When this is broken, there is a great tendency in the action of the muscles to pull the foot outward and backward; and to obviate this tendency is the leading indication of the treatment. The simple contrivance of Dupuy-

tren completely fulfils this indication, and merits more extensive trial than I have reason to believe it has met with from the practitioners of this country. It consists simply of one splint, extending from the top of the tibia four inches below the sole of the foot. A cushion of bran, folded double at the inferior part, where it touches the inner ankle, so as to take a conical shape, the base of which is directed downwards, is laid between the splint and the limb. The splint is confined by many turns of a bandage, and the foot turned inward, so that the sole looks towards the inner face of the splint. By the application of this force, the upper portion of the lower fragment is carried outward, while the foot is drawn inward, carrying with it, confined by the external lateral ligament, the inferior extremity of the fibula. The time of consolidation is from four to six weeks; but the joint may be considered in some danger of permanent lameness for a longer time, and therefore the patient should be required to use splints, and refrain from bearing the weight of the body upon the limb for several weeks longer. There are no points of special interest in the fractures which befall the bones of the foot (which are usually fractured by violent application of direct force), which need particular discussion.

I have thus completed a practical sketch of the subject of fracture, the difficulty of compressing which into a moderate space I did not at first appreciate; and I shall much regret, if, in laboring to be brief, I have become obscure.

# NOTES.

## NOTE A.

The following are the names of those Fellows of the Society who have departed this life during the past year:

| NAMES. | RESIDENCE. | DATE. | ÆT. |
|---|---|---|---|
| NATHANIEL BEMIS, | Watertown, | July 23, 1839, | 56 |
| THADDEUS BROWN, | Billerica, | Oct. " | 37 |
| †JACOB GATES, | Boston, | Oct. " | 65 |
| LEMUEL W. BELDEN, | Springfield, | Oct. 26, " | 38 |
| †ABIEL HEYWOOD, | Concord, | Oct. 29, " | |
| †GAMALIEL BRADFORD, | Boston, | Oct. 21, " | 44 |
| MATTHEW B. BAKER, | Springfield, | Sept. " | 30* |
| CHARLES CUTLER, | Grafton, | Dec. " | 25 |
| ELISHA MATHER, | Northampton, | April 24, 1840, | 48 |

The Hampshire Gazette contained the following obituary notice of Dr. Mather:

"In noticing the death of this good man and physician, it is not our object in this obituary to analyze particularly his character, or describe minutely the elements of which it is composed; but generally to bear testimony to his high standing in his profession, and the excellency of his character. Dr. Mather was, undoubtedly, more self-taught than most of his professional brethren. He was indebted to his talents, his industry and his application,

* Supposed.

for the rank which he attained. In all the various branches of his profession, he was entitled to entire confidence. With the structure and functions of the different parts of the human system, he was most intimately acquainted, and seldom surpassed in accuracy of anatomical knowledge. His practice was invariably founded upon physiological and pathological principles. He always thoroughly investigated the cause of disease, and applied his remedy accordingly; and though the public, as a mass, may not have awarded him that reputation, as a physician, to which he is justly entitled, those most competent to judge of his qualifications (the medical profession) have duly appreciated his great worth. Else, why is it that some of the most intelligent and skilful physicians have been so frequently accustomed to consult him on the most difficult and obscure cases? Why is it that the Massachusetts Medical Society have so long and so often honored him with many of their most important offices, and recently elected him on a very important committee, to revise its laws and regulations? Why is it that he was so much esteemed and beloved by those who best knew him, and reposed confidence in him as a family physician? The truth is, Dr. Mather was a practitioner of no ordinary character, and his loss will be long and deeply felt, especially by those of his profession who have been accustomed to look up to him for counsel in their doubts and in their perplexities. He possessed a clear and discriminating mind, sound judgment, quick perceptions, retentive memory, and prompt and decided action. He was affectionate and most generous in his feelings; honorable and most open himself, he seldom distrusted others. To kindness he was remarkably susceptible, and seldom or never forgot a favor.

"In his deportment he was neither forbidding nor imposing, but was affable and accessible to all; so that

his younger brethren could always approach him without being apprehensive that they should be overpowered by his feeling of superiority.

"In his domestic relations, he was greatly endeared. His conduct in his family was marked by the greatest purity and tenderness; and he here experienced his greatest happiness. As a Christian, he was exemplary, and no one doubts that he possessed the leading characteristics of a Christian character. 'Wo unto us, then, not him, for he sleeps in rest.'"

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The following notice of Dr. Belden, from a friend well able to appreciate the excellences of his character, contains a just tribute to his worth:

"The loss which a community sustains, in the death of an intelligent and beloved physician, is severe, and often irreparable; not so much that one of equal skill cannot be substituted, as that the confidence reposed in the *one* cannot immediately be transferred to the *other*. Such a physician is not only the medical adviser, but often, also, the friend and confidant of the sick; he sympathizes with them in their sufferings, enters into all their feelings, and is a comforter in all their trials. His presence and encouragement are often as beneficial as the medicine which he prescribes. When death removes him, they feel that their security is gone; that life is less valuable, because more uncertain, and because one of the sources of enjoyment is removed; and that a severe trial awaits them in selecting another in whose knowledge and judgment they can place the same confidence, and on whose integrity and friendship they can as safely rely.

"These reflections have been awakened by the widespread sorrow and lamentation occasioned by the death of that excellent man and estimable physician, Dr. Lemuel

W. Belden, of Springfield, Mass., who recently fell a victim to the malignant typhus fever, which has prevailed somewhat extensively in that vicinity.

"Dr. Belden was a native of Wethersfield, Conn., son of Dr. Joshua Belden, a respectable physician and most valuable man, who died of the epidemic spotted fever, in June, 1808, in the midst of life and in the full vigor of usefulness. Lemuel Whittlesey Belden, M. D., the subject of this memoir, was born September, 1801, and was left an orphan, with three younger brothers, in the care of a discreet and sensible mother, at the early age of seven years. Every care was given to his early education which a mother could bestow, and faithful and well qualified teachers could render; and at the age of sixteen, he entered the Freshman class of Yale College, September, 1817.

"During his minority, before and after he entered college, young Belden was a modest, reserved youth, fond of his books, which had greater attractions for him at this early age than the sports and amusements of his associates. The traits of character most prominent in his childhood, were *love of truth*, *sobriety*, and *consistency of conduct;* and these were no less conspicuous in all his after life. His reputation in college was always good, both for diligence as a scholar, and for exemplary and discreet deportment. If he did not acquire as rapidly as some others, he was always prepared for what was expected of him, always ready, and acquitted himself with honor. He was scrupulously regardful of all college duties, was never absent from prayers, and rarely, if ever, from recitations, during the whole of his college life. One of his most respectable classmates and constant friends writes thus of him: 'He was a diligent student; I think peculiarly so. It was evident that he never lost sight of the object for which he came there, and he attended to every study

prescribed, with steady perseverance. I can look back now and see evidence of maturity and soundness of judgment in this respect, which was uncommon at that age. His college course did not present much of incident, as it partook of the stability and steady attention to the object for which he came, which was afterwards so prominent a trait of his character. The loss of his sound judgment and growing attainments to the medical profession, you can appreciate better than I can.'

"He received the honors of college at his graduation, and the part assigned him on this occasion shows the estimation with which he was regarded by the authorities of the university, placing him among the most distinguished scholars of his class. After obtaining his first degree, in September, 1821, he took charge of a respectable academy in New Canaan, in his native State, where he continued two years, a very acceptable teacher. In the autumn of 1823, he relinquished this employment, and commenced the study of medicine with Dr. Woodward, then of Wethersfield, his native town, now the superintendent of the State Lunatic Hospital, Worcester, Mass. As a student of medicine, he was a close applicant, and made rapid proficiency; he availed himself of every means of acquiring professional knowledge; he was not only a diligent scholar, but was careful to watch the progress of such cases of disease as he could witness in a circuit of extensive country practice.

"His first course of medical lectures was attended in Boston, in the winter of 1825. The succeeding spring and summer he spent with his former preceptor, and devoted much time in visiting the sick, to ascertain the character and progress of disease. The following winter was spent in New Haven, attending the medical lectures in Yale College. In March, 1826, he received the degree of Doctor of Medicine. In both these institutions, he

obtained a high reputation as a scholar, and at his graduation he acquitted himself so well as to take the very first rank in his class.

"Returning from college, he again entered the office of Dr. Woodward as assistant in his practice, where he continued more than a year, attending extensively to the sick, and teaching the preliminary branches of study to a class of medical students. During this long intercourse, a warm friendship was formed between the preceptor and pupil, which continued till his death.

"Dr. Belden pursued the study of his profession with the ardor of a scholar and the spirit of a philanthropist. He loved his profession, because he considered it honorable and useful; he felt the responsibility that awaited him, and he was too conscientious to commence the practice of it without a thorough knowledge of its principles, and a faithful improvement of all his advantages for clinical knowledge and experience.

"In the autumn of 1827, he took up his residence in Springfield, where he soon gained a respectable practice, and became the favorite physician of many of the best families in the town.

"Dr. Belden had none of those shining qualities which commend themselves at first sight to the fancy of the many; he was not destined to be the popular man. He was peculiarly diffident and retiring; his manners were simple, but his deportment was dignified and reserved. He could obtain friends and business only by substantial merit. His success was not rapid, but permanent; those who once employed him rarely failed to adhere to him; the more extensive their acquaintance, the more they respected and loved him. To many he was the 'beloved physician,' rendered no less so by the amiable qualities of his heart, his upright and honorable deportment amongst men, than by his sagacity and tact as a physician. He

made no bustle in his business, and no display in the community in which he resided; but now that he is dead, they will realize that a man is gone from amongst them, whose influence, though quiet and gentle as the evening zephyr, has been wide and salutary, diffusing intellectual light and moral beauty wherever it was felt and known; that a physician has departed from their midst, in whose skill there was safety, in whose integrity there was confidence, in whose character there was rectitude unwavering, and in whose countenance ever beamed benevolence and philanthropy.

"Unlike many young men, Dr. Belden continued the habits of study through life, which he had early formed. In the intervals of his business, he was rarely found absent from his 'study.' Here he applied himself closely to professional reading, literature, and general intelligence. He was a thorough scholar, the *last* as well as the first year of his professional life. The readers of your Journal cannot have forgotten his lucid history of the case of Jane C. Rider, well known as the 'Springfield Somnambulist,' which occupied two weekly numbers of your periodical, and detailed, with great accuracy and precision, the wonderful phenomena of that remarkable case. This, with a popular work, published somewhat previously, on the same subject, constitute all the writings from his pen which have been given to the public. There are many things, however, in manuscript, which show his diligence in recording facts, no less than his ardor in the pursuit of knowledge.

"During the last year, Dr. Belden had interested himself in effecting a change in the Medical Society of this State. At their annual meeting in the spring, he presented his views to the Society in person, in so clear and perspicuous a manner as to induce those present to consider the subject seriously. A large and respectable committee was

appointed to act upon it, of which Dr. Belden was a member. Their report is just published, which recommends such changes as to meet the views of all who have interested themselves in it, retaining many of the old, and adopting some of the new, principles proposed by their author.

"Dr. Belden was married in May, 1829, to Miss Catharine Chester, daughter of Stephen Chester, Esq., late Sheriff of the County of Hartford, Conn.,—an amiable and accomplished lady, who survives him to mourn the loss of one of the best of husbands and kindest and most indulgent of men. He left no children; having lost an only son in early childhood.

"Few men are better situated to enjoy life than was Dr. Belden at the time of the attack of this fatal disease. His domestic relation was peculiarly felicitous; he was in the midst of an intelligent and enterprising population, who justly appreciated his medical attainments and moral worth. Beloved by his friends, respected by all who knew him, rising in reputation in his profession by the surest of all means—knowledge of his business and devotion to his patients, he had gained a character of sterling value in an extensive circle of practice. In the midst of this prosperity came the withering hand of disease and cut him off.

"The fever which terminated his life was mild in its apparent character, but lurking mischief was undermining the 'issues of life.' He went through the regular stages of disease, and was supposed to be slowly convalescing by himself and his medical friends. Strength and appetite had returned; he was able to walk to his favorite 'study,' where was the field of his most interesting pursuits. But these favorable appearances were delusive; fatal disease was preying upon him; a sudden hemorrhage sunk him rapidly, no remedies arrested its progress, and he died in

a few hours after the first apprehension of danger. His preparation for the fatal event, with a full knowledge of its approach, was as calm as if he had been preparing for a journey, or the reception of his friends. He made his will, gave directions about his property, resigned himself to the will of his Heavenly Father, and awaited the event in quiet submission. In this trying situation, with his friends weeping around him, he never lost his self-possession; his sedate and dignified deportment was the same in death as in life. He finished what was necessary for him to do, took leave of his friends, and expired. A friend, who witnessed his calm departure, thus writes: 'I have thought of you as one whom he loved and venerated; as one with whom he was so intimately associated during a portion of his life, that your opportunities of knowing him were greater than most of his friends possessed. I have longed to see you and to talk with you of the heavenly calm which marked the closing hours of his life, and the truly Christian preparation which was so distinctly manifested in his life and conversation. I have longed to hear from your own lips the tribute which I know you would pay to the worth of his intellect and heart. I am sure of your sympathy, for I know how you must have valued the friend we have lost.'

"Of the character of Dr. Belden, we may justly say it had no shades, no dark spots which his friends would desire to conceal or remove, no eccentricity which gave it the slightest singularity. From his childhood he loved truth, simplicity and virtue, and these were his eminent qualities. His well balanced mind led him to right views of every subject; he discriminated well, and judged correctly. His acute moral sense kept him in the strictest path of rectitude. A motive to do wrong never actuated him for a moment; his integrity was above suspicion. His mind was more distinguished for solid than for brilliant

traits; he had no dazzling qualities. He loved to investigate the truths of science and philosophy. His knowledge was of the substantial kind; he made no display of it, but it came to his aid when and where he needed it. As a physician, he had few equals of his age. He was a ripe scholar in the principles of his profession, and he made the best use of his experience. His Index Rerum shows how careful he was to note facts and references, and what stores of medical knowledge he was amassing. He was useful no less as a scholar than as a physician, and he was preparing for still greater usefulness and distinction.

"How desirable that such a man should live! And now that he is gone, how desirable is it to the living, as well as to the dead, that he was such a man! A long and intimate acquaintance with him left us ignorant of his faults; if his character had blemishes, they were invisible, surrounded and swallowed up as they were in estimable and amiable qualities. We love to contemplate the man, to look upon one so pure and blameless in life, fulfilling the relations of son, husband and father, brother and friend, in a manner so acceptable to all. His life was exemplary and well spent, his death a calm and dignified departure from scenes less congenial to his pure spirit, to the blessed fruition of a heavenly inheritance prepared by his Redeemer above.

"His loss is great to us all; to his family and relatives irreparable; but hardly less deeply to be felt by that circle of friends whose physician he was, whose affections he had secured, and who, on every return of affliction and suffering, will lament, with renewed sorrow, his premature departure."

## NOTE B.

The following cases, in which the immovable apparatus was tried, occurred in my practice during the last year:

### CASE I.

A young man had his leg fractured, six inches below the knee, by the fall of a barrel of flour in unlading a vessel. Both bones were broken. Considerable tumefaction existed. A bandage of strips was applied, and the fragments accurately supported by compresses and outside splints rolled in a splint-cloth. On the seventh day, the swelling and tenderness were so far reduced that I applied the splints of soaked pasteboard, and bandages soaked in starch. On the third day after this, the limb could be handled in any manner without pain, and the patient was able to sit at the window in a chair. On the fifteenth day from the accident, he was, without difficulty, conveyed in a chaise to the wharf, and put on board a vessel. The only inconvenience of the apparatus was occasioned by the diminished size of the limb leaving a space between the skin and splints.

### CASE II.

A middle aged man, the master of a coasting vessel, fractured his ulna by a fall, Oct. 5th, 1839. There was but little swelling or pain. Pasteboard splints and starch bandages were immediately applied. He was allowed to attend to his ordinary business without restriction. The apparatus produced some pain and numbness about the thumb and along the radial side of the arm. It was

removed on the 22d of November, when the union was found perfect. I think there was more pain in this mode of dressing, in this instance, than in that by well padded wooden splints; but there was a great convenience in being able to attend to business without confinement.

## CASE III.

A lad, seven years old, fractured both bones of his leg, July 11th, by falling with his leg entangled in a fence. The tibia slightly overlapped. The surrounding parts were moderately swelled, and painful. Powerful extension was made, which brought the bones into perfect coaptation, and produced comparative ease. A roller wet in water was applied from the toes to the knee. Over this were placed two splints of softened pasteboard, smeared with starch, and the whole was enveloped in many turns of a roller bandage soaked with starch. The first night was passed painfully, and required the use of opiates. For several succeeding nights the opiate was continued, from the force of habit, and afterwards all painful symptoms disappeared. At the end of twenty days, the apparatus was removed, and the bones found perfectly united. The splints, now perfectly moulded to the parts, were kept on fifteen days longer, and at the end of this time, the cure was completed. In this case, the immovable apparatus answered perfectly every desirable purpose.

## CASE IV.

A lad of fourteen years received several severe blows upon the leg, Nov. 20th, which fractured the tibia either at the epiphysis, or just below. The whole limb was bandaged, the knee and calf enveloped in softened pasteboard, and covered with many turns of a starched bandage.

*Nov.* 21.—Much pain and considerable swelling and tension from the toes to the middle of the thigh. Slight febrile disturbance.

*Nov.* 22.—Swelling mitigated,—pain less.

*Nov.* 23.—Febrile disturbance continues,—nervous restlessness at night,—pain and swelling diminishing,—the knee and ham are the most painful parts, and are sore to the touch. By the 2d of December, the eleventh day from the accident, the pain had ceased; and on removal of the bandages, on account of diminution in the size of the limb, the parts looked free from swelling and inflammation. The splints were reapplied over compresses of cotton batting. For the next three days, the pain was increased, especially in the foot and toes, at the end of which time the dressings were finally removed. A moderate swelling was discernible in the tibia, just below the knee. The union of bone appears complete. At this time, the patient possessed not the least power over the limb, and it was painful to the touch along the fibula and outer edge of the foot. A sensation of prickling and numbness was also complained of. For the next thirty days, the patient was entirely unable to support any weight upon the limb, and at the end of thirty more, had but little power of voluntary motion in the two smaller toes. At the end of three months, he could walk tolerably well with a cane, had recovered the power of voluntary motion in the muscles. The plumpness of the limb was restored, but its outside was somewhat painful to the touch, and the numbness and tingling had not totally disappeared. In this case, I am at a loss to decide whether the injury sustained by the nerves of the extremity was attributable to the blow which caused the fracture, or to the rigid confinement by the apparatus. On the whole, I am inclined to believe a better result would have followed the use of the common dressings. There was some excoriation in the ham.

## CASE V.

On the same day with the above, a lad of ten years fractured the ulna. The immovable dressings were immediately applied. These were followed by no swelling, and the pain was moderate. On the removal of the dressings, on the fifteenth day, the restoration of injured parts was perfect, the limb straight, and the place of fracture difficult to be discerned.

## CASE VI.

In August, a child of four years fell, bending his forearm under him. The radius and ulna were fractured, with a hinge-like motion between the fragments; the forearm very crooked. A strong extending force was necessary to straighten the limb. The immovable apparatus was applied, and continued without adjustment till September 3d, the seventeenth day from the accident, when the limb was found straight and strong, with a slightly elevated ridge at the place of fracture. No pain, inconvenience, or other troublesome symptom, was complained of during treatment.

## NOTE C.

The following tables were obtained by the labor of my friend and pupil, Mr. W. W. Morland. I think them worth preserving, as they exhibit concisely many important facts in regard to fracture which may aid in future investigations.

# TABLES RELATING TO FRACTURE,

COLLECTED FROM THE RECORDS OF THE MASSACHUSETTS GENERAL HOSPITAL, BOSTON, FROM 1821 TO 1840.

| Sex. | Age. | Nation. | Occupation. | Bones Fractured. | Nature of Fracture. | Cause. | Time of Union. | When Discharged. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| Female, | 45 | American, | | Tibia and Fibula, | Simple, | Fall, | 24 days, | 41 days, | |
| Male, | 22 | Irish, | Laborer, | Femur, Tibia and Fibula, | 1st Simple, 2d Compound, | Blow, | 18 " | 45 " | |
| " | 60 | Colored, | " | Tibia and Fibula, | Compound, | " | Amputation, | Death, | |
| " | 37 | American, | | " " | Simple oblique, | | 50 days, | 79 days, | |
| " | 56 | Scotch, | Laborer, | " " | Comminuted, | Fall, | | Death 16th day, | |
| " | 14 | English, | | Cranium, | | " | | " 2d " | |
| " | 37 | American, | Laborer, | Humerus, | Simp. Cominuted | | 20 days, | 32 days, | |
| " | 21 | " | | Patella, | Compound, | | 86 " | | |
| " | 26 | Irish, | Laborer, | Humerus, | Simple, | Blasting rocks | 113 " | | |
| " | 43 | American, | " | Tibia and Fibula, | Simple oblique, | | 54 " | 88 " | |
| " | 48 | " | Pump Maker, | Femur, | Simple, | Intoxication, | | Death, | |
| " | 47 | " | | External condyle of Humerus&olecranon, | | Fall, | No record, | No record, | |
| " | 24 | " | | Fibula, | | Jump, | 20 days, | 27 days, | |
| " | — | | | Tibia and Fibula, | Compound, | " | | Death in 2 hours, | |
| " | 24 | " | Truckman, | 6th Rib, | | | 42 " | 49 days, | |
| " | 16 | " | Sailor, | Femur, | | Fall, | 25 " | 30 " | |
| " | 15 | " | " | External condyle of Hum. & Acrom. Scap. | | " | | | |
| " | 46 | " | Fireman, | Tibia, Clavicle, | | Blow, | 120 " | 120 " | Delayed by necrosis of bone, |
| " | 35 | " | " | | | Fall, | 14 " | 28 " | Eloped, |
| " | 24 | " | Carpenter, | Femur, | Simple oblique, | " | 23 " | 30 " | |
| " | — | " | | 7th and 8th Ribs, | | | | 14 " | |
| " | 34 | " | Mason, | Clavicle, | | " | | 15 " | By request, |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Male, | 30 | American, | Boatman, | Tibia and Fibula, | Compound, | Fall, | | Death, | |
| " | 28 | Irish, | Laborer, | Humerus, | Comminuted, | Blow, | | | Went out before union, |
| Female, | 44 | " | Domestic, | Clavicle, | | Fall, | 19 days, | 34 days, | |
| Male, | 32 | American, | Mariner, | Fibula, | Simple, | " | | 19 " | |
| " | 51 | " | Laborer, | Femur, | | " | | Death in 4 days, | |
| " | 26 | " | Cooper, | Olecranon Ulna, 3 short Ribs, | | Fighting, | | 17 days, | |
| " | 34 | " | Carpenter, | Tibia and Fibula, | Compound, | Fall, | 44 " | 59 " | |
| " | 25 | " | Hackman, | " " | Simple, | | 36 " | 42 " | |
| " | — | Irish, | Laborer, | Clavicle, | " | " | 30 " | 32 " | |
| " | 35 | American, | Mariner, | Tibia and Fibula, | Comminuted, | | | | |
| Female, | 28 | Irish, | | Fibula, | Compound, | Fighting, | | Death, | |
| " | 47 | American, | | " | " | " | 42 " | 42 days, | |
| Male, | 51 | Irish, | Laborer, | Clavicle, | Simple, | | | | |
| " | 18 | American, | Hostler, | Cranium, | | | | | |
| Female, | 32 | " | | Tibia and Fibula, | | | 28 " | | |
| Male, | — | English, | Laborer, | " " | Contused, | Run over, | Uncertain, | 64 " | |
| " | — | American, | | Radius and Ulna, | Simple, | | | | |
| " | — | Madeira, | | Tibia, | " | | 24 days, | 28 " | |
| Female, | — | American, | | Acromion Scapula, | | | | 28 " | |
| Male, | — | " | | Femur and Little finger, | 1st Simple, 2d Compound, | | | Death, | |
| " | — | Irish, | " | Femur, | Simple, | Blow, | No record, | 53 days, | |
| " | — | American, | | Humerus, | Compound, | | | Death in 24 hrs. | |
| Female, | — | " | | External condyle of Humerus, | | Thrown frm Carriage, | | 15 days, relieved, | |
| Male, | — | " | | Cranium & Femur, | Compound, | | | Death in 30 min. | |
| " | — | " | | Ribs, | | Jammed, | 21 days, | 28 days, | |
| " | — | " | | Tibia and Fibula, | | | 33 " | 55 " | |
| Female, | — | " | | Patella, | Simple, | Fall, | 28 " | 28 " | |
| Male, | — | " | | Fore-arm, Clavicle, | | | 32 " | 32 " | |

| Sex. | Age | Nation. | Occupation. | Bones Fractured. | Nature of Fracture. | Cause. | Time of Union | When discharged. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| Male, | — | Irish, | Laborer, | Cranium, | | Fall, | | Death in 24 hrs | |
| " | — | " | " | Cervix Femoris, | | | | | Refractory, |
| " | — | American, | " | Humerus, | Compound, | Kick of horse, | | 9 days, | Doing well, |
| " | — | Irish, | | Tibia and Fibula, | | | 'Considerable' in 30 days, | 54 " | |
| " | — | American, | | Fibula, | | | | 89 " | |
| " | — | " | | Femur, | | | 37 days, | 56 " | |
| " | — | " | | Ribs, | | Fall, | | 19 " | |
| Female, | — | " | | Radius, | | | | 30 " | Relieved, |
| " | — | " | | Cervix Femoris, | | " | 111 " | 133 " | " |
| Male, | — | " | | Femur, Tibia and Fibula, | " | " | 30 " | 50 " | |
| " | — | " | | Tibia, | Simple, | | 23 " | 37 " | |
| " | — | " | | " | Compound, | | 32 " | 46 " | |
| " | — | " | | " | Simple, | | Out of house, | 30 " | " |
| Female, | — | " | | External condyle of Humerus, | | Fall on elbow, | 89 days, | 89 " | Could raise hand to mouth, |
| Male, | — | " | " | Femur, | " | Fall in a fit, | No record, | 48 " | |
| " | — | " | " | Tibia and Fibula, | Compound, | Fall, | | 76 " | Amputation, |
| Female, | — | | | Femur, | Simple, | " | " | | |
| Male, | — | Irish, | " | " | " | | " | | |
| " | 42 | Italian, | Gold-beater, | Tibia, | " | " | " | | |
| " | 39 | American, | Laborer, | Femur, | Simp. transverse, | | 28 days, | 64 " | |
| " | 32 | " | | Tibia and Fibula, | | Blow, | | 30 " | |
| " | 21 | " | Machinist, | Patella, | | Fall, | 56 " | 56 " | |
| Female, | — | " | | Femur, | | " | | Death in 30 days, | |
| Male, | 34 | Irish, | Laborer, | Tibia and Fibula, | | | 34 " | | |
| " | 37 | " | " | " " | | | Uncertain, | | Had Erythema, |
| " | — | American, | " | Clavicle, | Simple, | " | 21 days, | 28 " | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Male, | 22 | American, | | Clavicle, | Simple, | Blow, | No record, | 26 days, | |
| " | 54 | " | Mason, | " | " | " | " | 39 " | Broken in 2 plcs |
| " | — | " | Sailor, | Cranium, | | | 34 days, | 38 " | Lft parietal bone, |
| " | 36 | " | Trader, | Os temporis and Os sphenoides, | | Fall, | | Death in 3 days, | |
| " | 63 | " | | Cranium, | | Blow, | | " 36 hours, | |
| " | 27 | " | Sailor, | Tibia and Fibula, | Compound, | Fall from the main-top, | 26 " | 46 days, | Well, |
| " | 50 | Colored, | | Fibula, | | | | 15 " | Relieved, |
| " | 21 | Irish, | Laborer, | Humerus, Tibia and Fibula, | Simple, | | 24 " | 60 " | Humerus in 3 places, |
| " | 28 | American, | " | Ilium, | | | 20 " | 24 " | Fracture from ischiatic notch over dorsum ilii to ant. sup. spin. pro. |
| " | — | " | Teamster, | Jaw, | | Fall, | 15 " | 15 " | |
| " | 34 | Irish, | Laborer, | Tibia and Fibula, | | | | No record, | |
| " | — | German, | Seaman, | Head of Tibia, | | " | No record, | 74 days, | Artificial joint, |
| " | — | Irish, | Laborer, | Tibia and Fibula, | " | Blow, | 40 days, | 64 " | Un.beg.12 days, |
| Female, | 30 | American, | | " " | | | 15 " | 90 " | |
| Male, | 57 | " | Carpenter, | Ankle, | | Fall, | | 47 " | Dislocation, |
| Female, | 56 | " | | Tibia and Fibula, | " | | | * | Dismis. refract. |
| Male, | 37 | " | Laborer, | " " | " | | | | Cured in 119 ds. |
| " | 27 | " | " | Tibia, | Compound, | Scuffle, | | | Amp. & Death, |
| " | 31 | " | Sailor, | Tibia and Fibula, | Simple, | | 34 days, | 67 days, | |
| " | 49 | " | Shoe Maker, | " " | " | | | | Amp. & Recov. |
| Female, | 29 | " | | " " | | | No record, | 35 " | |
| Male, | 23 | " | Rope Maker, | " " | " | Blow, | 35 days, | 38 " | Nearly united in 24 days, |
| " | 21 | " | | Humerus, Tibia and Fibula, | | Fall, | 24 " | 50 " | |
| " | 49 | " | Carpenter, | Tibia and Fibula, | Simple, | " | None, | | Delir. tremens, |
| " | 27 | " | Shoe Maker, | " " | Compound, | | Amputation, | | Had sores, Amp |
| Female, | — | " | Domestic, | Patella, | | Blow, | | 44 " | Nearly well, |
| " | 41 | " | " | Head of Radius, | | Fall, | | 31 " | Well, |

| Sex. | Age. | Nation. | Occupation. | Bones Fractured. | Nature of Fracture. | Cause. | Time of Union | When Discharged. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| Male, | 13 | American, | Domestic, | Radius, | Simple, | Fall, | | 32 days, | Nearly united in 13 days, |
| " | 30 | " | | Ribs, | | | | 8 " | Well, |
| " | 26 | " | Carpenter, | 5th and 6th Ribs, | | | | 100 " | Respira. affected and unwell, |
| " | — | Irish, | | Scapula, | | | | 7 " | Well, |
| Female, | 52 | American, | | " | | " | 45 days, | 45 " | |
| " | 70 | " | | Acromion Scapula, | | | | 43 " | Well, |
| Male, | 51 | " | " | Ankle, | Compound, | " | 46 " | 46 " | Dislocation, |
| " | — | German, | Seaman, | Tibia, | | " | 55 " | 82 " | |
| " | 42 | American, | Translator, | " | | | | 84 " | Intemperate, |
| " | 32 | " | Laborer, | " | Simple, | " | 35 " | 35 " | Well, |
| " | — | " | Merchant, | Femur, | " | " | | 59 " | " |
| " | 35 | " | Laborer, | " | " | Blow, | | Death in 4 days, | Del. trem. no ex. |
| " | 23 | " | Painter, | Femur and Patella, | Comp. Comminu. & Complicated, | Fall, | | | Amputation and death, |
| " | 21 | " | | Femur, | Simple, | " | 48 " | 48 " | Well, |
| " | 17 | " | Laborer, | " | " | " | 40 " | 69 " | " |
| " | 22 | Spaniard, | Merchant, | Radius and Ulna, | | | Out of house, | | |
| " | 35 | American, | Hostler, | Tibia and Fibula, | " | | 64 days, | 89 " | |
| " | 55 | " | | Cervix Femoris, | | " | | | Dis. by request, |
| Female, | 50 | " | | Radius, | | | Out of house, | | |
| " | 30 | " | | " | | | 56 days, | | Relievd. fm œdem. and paralysis, |
| " | 35 | " | | Tibia and Fibula, | " | | 57 " | 57 " | |
| Male, | 35 | " | Cane worker, | Tibia, | | | 63 " | | Out of house, |
| Female, | 73 | " | | Femur, | | | | | Dismiss. refrac. |
| Male, | 24 | Irish, | Laborer, | Tibia and Fibula, | Compound, | | 25 " | 25 " | "Quite firm," |
| " | 22 | " | " | Fibula, | | | 22 " | 32 " | Luxation of Tib. |
| Female, | 60 | | | Ribs, | | Blown down, | | Death in 45 days, | Cough, bldy spu. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Male, | 51 | American, | Laborer, | Cervix Scapula, | | | 34 days, | 34 days, | |
| " | 10 | | | Femur, | Compound and Comminuted, | | | | Amputation, |
| " | 19 | " | Distiller, | Tibia and Fibula, | Simple, | Bursting of a still, | 40 " | 40 " | |
| " | 28 | " | Hostler, | " " | Compound, | | 25 " | 42 " | |
| " | 24 | " | Laborer, | Os maxil. inferius, | | | | 18 " | Dis. by request, |
| Female, | 33 | " | Sempstress, | Tibia, | | | 17 " | | |
| Male, | 46 | " | Cabinet makr | " | Simple, | Fall, | 36 " | 36 " | |
| " | 16 | " | | Condyle of Humer. | | | 16 " | 16 " | Splints removed, |
| Female, | 23 | " | Domestic, | Cranium, | | | | 129 " | Depress. Treph. |
| Male, | 40 | Irish, | | Tibia, | " | | | 59 " | Beg. in 29 days, |
| " | 47 | American, | Farmer, | Tibia and Fibula, | Comp. and Com. | | 37 " | 51 " | |
| " | 27 | Irish, | Truckman, | " " | Comminuted, | | | 57 " | Amputation, |
| " | 34 | American, | | Tibia, | Compound, | Blow, | 24 " | 28 " | |
| " | 32 | " | Laborer, | Femur, Tibia and Fibula, | " | Fall, | 42 " | 42 " | |
| " | 24 | Irish, | " | Tibia and Fibula, | Comminuted, | | 21 " | 50 " | |
| " | 28 | American, | Teamster, | Ribs, | | | 20 " | 20 " | Well, |
| " | 11 | " | | Tibia, | | | 23 " | 25 " | |
| " | 72 | " | | Femur, | Simple, | | | Death in 10 days, | Idiotic, |
| " | 24 | Irish, | Laborer, | Clavicle, | | Blow, | 29 " | 45 days, | |
| " | 28 | " | Gardener, | Ribs, | | | 8 " | 20 " | |
| " | 32 | " | Laborer, | Clavicle, | | | | 8 " | Refrac.& not relieved, |
| " | 47 | American, | " | " | | | 18 " | 20 " | |
| " | 64 | " | Mariner, | Cervix Femoris, | | | | 130 " | Not relieved, |
| " | 33 | Irish, | Laborer, | Humer. ulna and os maxillare inferius, | Comminuted, | Jump, | Of jaw 62 ds, | | Delirious, |
| " | 27 | " | " | Tibia and Fibula, | Compound, | | | 109 " | |
| " | 40 | American, | Hatter, | Femur, | | | 108 days, | 114 " | Intemperate, |
| " | 29 | " | Laborer, | Tibia, | " | Fall, | 126 " | | Piece bone rem. |
| Female, | 23 | " | Domestic, | Condyle of Humer. | | | 27 " | | |

| Sex. | Age. | Nation. | Occupation. | Bones Fractured. | Nature of Fracture. | Cause. | Time of Union. | When Discharged. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| Male, | 21 | American, | Laborer, | Humerus, | | Fall, | 26 days, | 28 days, | |
| " | 42 | " | Paper Maker, | " | Simple, | | 37 " | | Fell in convul. fit |
| " | 30 | " | Laborer, | Patella, | " | | 21 " | 56 " | Could then wlk. |
| " | 13 | Irish, | | Femur, | " | Blow, | 22 " | | |
| " | 45 | American, | " | Fibula, | " | " | 17 " | 28 " | Well, |
| " | 40 | " | Mason, | Tibia, | Comp. and Com. | | 41 " | 41 " | Partial un. 26 ds. |
| " | 43 | " | Ferryman, | Patella, | Simple, | | 30 " | 45 " | Beg.to wlk 21 ds |
| " | 62 | " | Laborer, | Tibia and Fibula, | | | 23 " | 28 " | Contusion, |
| Female, | 26 | Irish, | Domestic | Femur & Fore-arm, | Comp. and Com. | Jump, | | Death in 3 days, | Intemperate, |
| Male, | 30 | " | Laborer, | Ribs, | | | 24 " | 24 days, | Emphysema, |
| " | 12 | American, | | Tibia, | Simple, | | No record, | 23 " | |
| " | 33 | " | Hostler, | Femur, | | " | 41 days, | | Mania a potu, |
| " | 34 | " | Painter, | Cranium, | | Fall, | | Death in 7 days, | |
| " | 42 | Irish, | Laborer, | Clavicle, | | Blow, | | 4 days, | Much relieved, |
| " | 28 | American, | Ship Carpent. | " | | | 10 " | 10 " | Well, |
| " | — | Irish, | Laborer, | Femur, | " | | 20 " | 40 " | |
| " | 21 | " | " | Fem. Tibia & Fibu. | Comp. & Laceratd | Run over, | | Death in 8 hours, | Amputation, |
| " | 37 | " | " | Os maxillare infer. | Compound, | | | 7 days, | Much relieved, |
| " | 22 | " | Carpenter, | Fibula, | | | 14 " | 21 " | Walkd in 21ds. |
| " | 38 | " | Laborer, | Tibia and Fibula, | Comminuted, | | 21 " | 35 " | |
| " | 32 | " | " | Metacarpal bones, | " | | | 28 " | Relieved, |
| " | 38 | American, | " | Fibula, | Compound, | | 31 " | | |
| Female, | 56 | " | Domestic, | Radius, | Simple, | Fall, | | 4 " | Much relieved, |
| Male, | 21 | " | Laborer, | Tibia and Fibula, | | | | | Fract.bx.taken off |
| Female, | 40 | Irish, | " | Clavicle, | Comminuted, | | 22 " | 31 " | 25 dys, walked on |
| Male, | 36 | " | " | Femur & Clavicle, | Simple, | Blow, | 22 " | 35 " | crutches in 52 dys. |
| " | 24 | " | " | Tarsal & Metatarsal | Comminuted, | | | Death in 15 dys, | had ulcer on foot, |
| " | 21 | " | " | Clavicle, | Simple, | Fall, | 14 " | 14 days, | Gangrene, Amp. |
| " | 43 | American, | Mariner, | Tibia, | " | | 26 " | 26 " | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Female, | 21 | Irish, | Domestic, | Fibula, | Simple, | | 17 days, | 26 days, | |
| Male, | 22 | " | Laborer, | Femur, | " | | 57 " | 57 " | Slight un. 46 ds. |
| " | 40 | " | " | Femur and Ulna, | " | | Ul. 14 Fem. 44 | 44 " | Broken 2 places |
| " | 38 | American, | " | Femur, | " | | 33 days, | 33 " | |
| " | 30 | Irish, | " | Patella, | " | Fall of earth, | | 97 " | Anchy. of joint, |
| " | — | American, | " | Sternum and Ribs, | | Fall, | | Death in 3 days. | Emphysema, |
| " | 27 | Irish, | " | Ribs, Tibia & Fibu. | Comp. and Com. | " | 34 " | 53 days, | Fell 60 feet, |
| " | 29 | American, | " | Tibia and Fibula, | Compound, | | 66 " | | |
| Female, | 56 | " | | Femur, | " | " | | Death in 30 days. | |
| Male, | 25 | Irish, | " | " | " | | Slight in 86, | 1 year, | Only relieved. |
| " | 25 | American, | Stone Cutter, | Fem. Radius & Ul. | " | | | Death in 5 days, | |
| " | 27 | Irish, | Laborer, | Tibia and Fibula, | Simple, | " | 52 days, | | |
| " | — | English, | Seaman, | Humerus, | " | Blow, | 27 " | | |
| " | 25 | American, | Manufacturer | Femur, | " | | Out of house, | | |
| " | 18 | English, | Seaman, | Humerus, | " | | 16 " | 18 days, | |
| " | 60 | Irish, | Laborer, | Ribs, | | | | 7 " | |
| " | 23 | " | Carpenter, | Cranium, | | | | 75 " | Well, |
| " | 31 | American, | Seaman, | Ribs, | | Fall, | 20 " | 20 " | |
| " | 21 | " | " | Femur, | " | " | 32 " | | |
| " | 39 | Irish, | Laborer, | Cervix Femoris, | " | " | 23 " | | |
| " | 26 | American, | Seaman, | Olecranon Ulnæ, | " | | 13 " | | |
| " | 33 | " | Laborer, | Humerus, | " | Blow, | 36 " | | |
| " | 32 | Irish, | " | Fibula, | " | Fall, | 20 " | | |
| " | 24 | American, | Barber, | Tibia and Fibula, | " | | 28 " | | |
| " | 21 | Irish, | Laborer, | Clavicle, | | | 18 " | | |
| " | 29 | American, | | Tibia, | " | | 22 " | | |
| " | 48 | " | H'dcartman, | " | " | Pushed down | 49 " | | |
| " | 21 | " | Seaman, | Ulna, | " | Blow, | | | Sent to Ma. Hos. |
| " | 33 | Irish, | Laborer, | Clavicle, | " | | 12 " | | |
| " | 26 | American, | Wheelwright | Vertebræ, | " | Fall, | | Death in 2½ ds. | |
| " | 19 | Irish, | Laborer, | Fibula, | " | " | 35 " | | Broken in 3 plcs |
| " | — | " | Tailor, | Humerus, | " | | 26 " | 26 days, | Well, |

| Sex. | Age. | Nation. | Occupation. | Bones Fractured. | Nature of Fracture. | Cause. | Time of Union. | When Discharged. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| Male, | 20 | Irish, | Laborer, | Cranium, | | Fall, | | Death in 1 hour, | |
| " | 31 | American, | Hatter, | Patella, | Simp. transverse, | Jump, | 19 days, | 35 days, | |
| " | 26 | Irish, | Laborer, | Tibia and Fibula, | " | Fall, | 58 " | 58 " | |
| " | 32 | American, | | Femur, | Simple, | Run over, | 21 " | | |
| " | 39 | " | Farmer, | Tibia and Fibula, | " | | | | Went out before union, |
| " | 30 | Irish, | Laborer, | Femur, | " | | 37 " | | |
| " | 25 | " | " | Cranium, | | | 39 " | 39 " | Brain pulsated, |
| " | — | " | " | Femur, | " | | 32 " | 52 " | |
| " | 56 | American, | Carpenter, | Cervix Femoris, | | | 38 " | | Not firm, |
| " | 54 | " | " | Fibula, | " | | 21 " | | Contused, |
| " | 40 | " | Laborer, | Cervix Femoris, | | Fall, | 65 " | | |
| " | 58 | " | " | Fibula, | | | 24 " | | |
| " | 36 | Irish, | Grocer, | Cranium, Tibia & Fibula, | | Run over, | | Death in 24 hrs. | |
| " | — | " | Laborer, | Tibia, | " | Fall, | 43 " | | |
| " | 28 | " | " | Cranium, | | Blow, | | | Trephin'd,&dis |
| " | 23 | Colored, | Steward | Clavicle, | | " | | | Much rel. 24 ds. |
| " | 32 | Irish, | Laborer, | Femur, | Compound, | Fall of earth, | | Death 135 days, | |
| " | 47 | American, | Seaman, | Tibia and Fibula, | Simple, | Fall, | | Death in 3 days, | Delir. tremens, |
| " | 7 | " | | Femur, | " | Run over, | 20 " | 26 days, | |
| " | 42 | " | Laborer, | 7th and 8th Ribs, | | Fall, | | 6 " | Much relieved, |
| " | 30 | Irish, | " | Femur, | " | | 38 " | 38 " | |
| " | 35 | " | " | Tibia, | Compound, | Blow, | 32 " | | |
| " | 13 | American, | | Femur, | " | Run over, | | Death in 18 days, | |
| " | 12 | " | | Os Humeri, | Simple, | Fall on ice, | 31 " | | Near condyles, |
| " | 25 | Irish, | " | Femur, | " | Blow, | 43 " | 43 days, | |
| " | 48 | American, | Clerk, | Radius and Ulna, Tibia and Fibula, | Comp. and Com. | Run over, | | Death in 1 day, | |
| " | 23 | Irish, | Domestic | Os maxillare infer. | Simple oblique, | Fighting, | 16 " | 16 days, | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Male, | 39 | American, | Hackman, | Tibia and Fibula, | Simple oblique, | | | Death in 9 days, | |
| " | 52 | " | Cartman, | Cranium, | | Run over, | 20 days, | 20 days, | |
| Female, | 57 | " | | Cervix Femoris, | | | 37 " | 84 " | |
| Male, | 50 | Irish, | Laborer, | Tibia, Fibula and 7th Rib, | Compound and Comminuted, | | 55 " | | |
| " | 22 | American, | " | Tibia and Fibula, | Compound, | | 42 " | 42 " | |
| " | 32 | Irish, | " | " " | " | | | 134 " | Bone exf. rel. |
| " | 36 | " | " | Femur, | Simple, | | 50 " | 50 " | |
| " | 35 | American, | Ship Carpent. | Tibia and Fibula, | Compound, | Jammed, | | | Partial un. 52 ds. |
| " | 43 | " | | Olecranon Ulnæ, | | Jump, | No record, | 70 " | Relieved, |
| " | 27 | " | Fireman, | Clavicle, Tibia and Fibula, | " | Jump from a locomotive, | | Death in 8 days, | |
| " | 25 | Irish, | Laborer, | Tibia and Fibula, | Comp. and Com. | Run over, | | Death in 7 hours, | |
| " | 30 | " | " | " " | Simple, | | 27 days, | 34 days, | |
| " | 27 | | Stoneworker, | Radius and Ulna, | | | 28 " | 28 " | |
| " | 10 | American, | | External condyle of Humerus, | | | 15 " | | |
| " | 22 | Irish, | Laborer, | Femur, | Simple oblique, | | 46 " | 80 " | |
| Female, | 22 | " | Domestic, | Clavicle & Radius, | | Fall, | 31 " | 31 " | |
| Male, | 35 | Scotch, | Laborer, | Ribs and os maxil. inferius, | | Run over, | 46 " | | |
| " | 33 | N. Scotia, | Seaman, | Tibia, | Simple, | | 23 " | | |
| Female, | 20 | Irish, | Domestic, | Clavicle, | " | Fall, | 28 " | 31 " | |
| Male, | 30 | | Laborer, | Tibia and Fibula, | " | | 52 " | 52 " | Some un. 23 ds. |
| " | 24 | American, | Truckman, | Fibula, | | | 29 " | | |
| " | 28 | N. Scotia, | Laborer, | Olecranon Ulnæ, | | " | 22 " | | |
| " | 32 | American, | " | Femur, | | | | 128 " | Much relieved, |
| " | 24 | Irish, | " | Tibia and Fibula, | Compound, | | 37 " | | |
| " | 19 | American, | " | " " | Comp. and Com. | " | 66 " | | Some un. 47 ds. |
| " | 17 | Irish, | " | " " | Simp. transverse, | Wrestling, | 32 " | 32 " | Un. beg. 14 days, |
| " | 22 | " | " | " " | Comp. and Com. | Run over, | | Death in 24 hrs. | |
| " | 30 | " | " | Femur, | Simple oblique, | " | 69 " | 69 " | 'Considbl.' 14 ds |

| Sex. | Age | Nation. | Occupation. | Bones Fractured. | Nature of Fracture. | Cause. | Time of Union. | When Discharged. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| Female, | 27 | Irish, | Cook, | Fibula, | | Fall, | 36 days, | 43 days, | Rup. tibio-tar. lig. |
| Male, | 39 | " | Laborer, | Tibia and Fibula, | Comp. and Com. | Run over, | | | Amputation and |
| Female, | 43 | " | | " " | | | 24 " | 26 " | death, |
| Male, | 28 | " | Brick maker, | Ribs, os maxil. inf. | | | | Death in 5 days, | |
| " | 28 | American, | Laborer, | Clavicle, | | Blow, | 16 " | 16 days, | |
| " | 25 | " | Chaise trim. | Femur, | Simple oblique, | Fall of a log, | 42 " | | |
| Female, | 45 | Irish, | Washwoman | " | | | 76 " | 76 " | Some un. 45 ds. |
| " | 57 | American, | Nurse, | Fibula, | | | 35 " | 35 " | Disloca. of Tib. |
| Male, | 68 | English, | Porter, | Patella, | Transverse, | | 46 " | | |
| Female, | 22 | " | | Tibia and Fibula, | Compound, | Jump, | 104 " | 104 " | "Much reliev." |
| Male, | — | American, | Teamster, | Os maxil. inferius, | | Run over, | | 4 " | "Relieved," |
| " | 45 | " | Carpenter, | Femur, | | | 37 " | | "Very consid- |
| " | 40 | Swede, | Laborer, | Tibia, | Simp. transverse, | Fall, | 28 " | 28 " | erable," |
| " | 30 | American, | Blacksmith, | Tib. Fib. os maxil. inf. & index finger, | Compound, | Explosion, | | Death in 8 days, | Finger Amput. |
| " | 23 | " | Laborer, | Cranium, | | " | | 8 days, | Relieved, |
| " | — | " | Seaman, | Humerus, | | Fall of 20 ft. | | Death in few hrs. | Inward disloca. |
| " | — | Irish, | Laborer, | Tibia, | Simple, | | 52 " | | Erythema, in- |
| Female, | 7 | " | | Os maxil. inferius, | | | 54 " | 54 days, | temperate, |
| Male, | 28 | German, | " | Ribs, | | Fall of 6 feet, | 19 " | 19 " | No emphysema |
| " | 33 | American, | " | Tibia and Fibula, | Simp. transverse, | Push'd down | 38 " | | |
| " | 30 | Irish, | " | " " | Compound, | Fall of earth, | | Death in 9 days, | Amputation, |
| " | 25 | American, | | Ribs, | | | | 54 days, | Emphysema, — |
| " | 23 | " | Cartman, | Cranium & Tibia, | Tibia simple, Cranium crushed, | Fall frm 4th story, | | Death in few hrs. | much relieved, |
| " | 23 | " | Blacksmith, | Bones of the hand, | Compound, | St'm engine, | | | Amp. well 34 ds. |
| " | 40 | " | Laborer, | Ulna and Fibula, | | | 47 " | 47 days, | |
| Female, | 36 | " | Domestic, | Humerus, | | | 21 " | 44 " | |
| Male, | 28 | Irish, | Seaman, | Cran. Tibia & Fibu. | | | | Death in few hrs. | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Male, | 30 | American, | Teamster, | Femur, | | | 42 days, | 42 days, | Con. un. 26 ds. |
| " | 35 | " | Laborer, | Digiti, | | | 34 " | 34 " | Ps.of bone rem. |
| Female, | 20 | Irish, | Domestic, | Os innominatum, | | Jump from 4th story, | 38 " | | Could bear little weight on leg, |
| Male, | 17 | American, | Chair maker, | Condyle of Humer. | | Fall, | 37 " | 37 " | 'Mch relieved,' |
| " | 24 | Irish, | Teamster, | Femur, | Simple, | | 31 " | 42 " | |
| " | 12 | American, | | Radius, | " | | | | |
| " | 32 | Irish, | Stucco wrker | Femur, | Spontaneous, | Secondary syphilis, | 108 " | 128 " | 'Much reliev.' |
| " | 65 | American, | Laborer, | Tibia and Fibula, | Comp. & Com. | Blown up, | | 83 " | Not relieved, |
| " | 45 | Irish, | " | " " | " | | | Death in 13 ds. | Right leg amp. |
| Female, | 48 | American, | Nurse, | Clavicle, | | Fall, | 34 " | 34 days, | |
| Male, | 27 | " | Painter, | Tibia and Fibula, | " | " | | 105 " | Amputation, |
| Female, | 73 | " | | Cervix Femoris, | | " | 38 " | 94 " | Well, |
| Male, | 51 | English, | Laborer, | Femur, | Simple oblique, | | 54 " | 71 " | |
| " | 29 | American, | Painter, | Ribs, | | Run over, | | Death in 37 ds. | Disloca. clavicle & dors.vertebræ |
| " | 40 | " | Grocer, | Fibula, | | | 45 " | 45 days, | Much relieved, |
| " | — | " | | Tibia and Fibula, | Simple, | | | | Record imperf. |
| " | 26 | " | Teamster, | " " | Comp.Lacerated, | " | | | Amputation, |
| " | 15 | Irish, | | Femur, | Simple, | Fall fm horse | 32 " | 35 " | |
| " | 37 | German, | Laborer, | Tibia and Fibula, | " | | 38 " | 38 " | Tol. firm 30 ds. |
| " | 15 | American, | | Humerus, | " | | 30 " | 30 " | |
| " | 28 | " | Blacksmith, | Tibia and Fibula, | Simple oblique, | | 90 " | 46 " | |
| " | 44 | Irish, | Laborer, | Radius & Femur, | " | Blow, | 34 " | 70 " | |
| " | 21 | American, | Seaman, | Femur, | | | | 9 months, | Only partial, |
| " | 31 | Irish, | Laborer, | Tibia and Fibula, | Comp.Lacerated, | R. R. cars, | | Death in few hrs. | Amputation, |
| " | 29 | American, | " | " " | Simple oblique, | Blow, | 36 " | 36 days, | |
| " | 22 | " | Truckman, | 1st lumber Vertebra | | | | 42 " | No paralysis, |
| " | 22 | Irish, | Laborer, | Metacarpal bones, | | Run over, | 36 " | | Much relieved, |
| " | 26 | " | " | Tibia, | Simp. transverse, | R. R. cars, | 32 " | 48 " | |
| " | 35 | " | " | " | Comminuted, | Blown over, | 99 " | | " |

| Sex. | Age. | Nation. | Occupation. | Bones Fractured. | Nature of Fracture. | Cause. | Time of Union. | When discharged. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| Male, | 21 | Irish, | Laborer, | 6th and 7th cervical vertebræ, | | Fall of bank of earth, | | Death in 30 days, | |
| " | 35 | " | " | Tibia and Ilium, | | | | " 3 " | |
| " | 20 | American, | " | Sternum, | | | | 20 days, | Much relieved, |
| " | 24 | " | Carpenter, | Tibia and Fibula, | Simple oblique, | Fall, | 18 days, | 42 " | " " |
| " | 29 | Scotch, | Seaman, | Os maxil. inferius, | " transverse, | " | 81 " | 81 " | Well, |
| " | 40 | American, | Laborer, | Ribs, | | Blow, | 20 " | 20 " | " |
| " | 40 | English, | Seaman, | Tibia and Fibula, | Simple, | Blow, | | 140 " | Some un. 25 ds. |
| " | 24 | American, | Teamster, | Tibia, Fibula and os calcis, | Compound, | Fall, | | Death in 19 days, | |
| " | 27 | " | Stable keeper | Humerus, | | Kick of horse, | | 7 " | Relieved, |
| " | 30 | Irish, | Laborer, | Pelvis, | | Jammed, | 17 " | 25 " | Walk'd in 17 ds. |
| " | 33 | " | " | Tibia, | Simple oblique, | | 14 " | 24 " | Bears weight, |
| " | 55 | American, | Farmer, | Cranium, | | Fall, | | Death in 8 hours, | Trephined, |
| " | 25 | Irish, | Laborer, | Tibia and Fibula, | Comp. and Com. | Blasting rocks | | " 4 " | |
| " | 25 | " | Teamster, | Femur, Tibia and Fibula, | Compound, | Run over, | 71 " | 81 days, | Walks without crutches, |
| " | — | | Mariner, | Ribs, | | | | 5 " | Much relieved, |
| Female, | 43 | American, | Domestic, | Radius and Ulna, | Simple, | Fall, | 20 " | 20 " | |
| Male, | — | Irish, | Laborer, | Clavicle, | | Fall of 7 ft. | 27 " | 31 " | Well, |
| " | 48 | American, | Tanner, | Tibia and Fibula, | " | Blow, | 49 " | | Un.out of house, |
| " | 33 | " | Cordwainer, | Femur, | " | Fall, | 14 " | 14 " | Walked, |
| " | — | " | Laborer, | Os maxil. inferius, | | Blow, | 23 " | 23 " | |
| " | 31 | " | Housewright | Tibia and Fibula, | Simp. transverse, | Fall, | 32 " | 32 " | Walked in 9 ds. |
| " | 9 | " | | " " | Simple, | | 18 " | 23 " | Much relieved, |
| " | 30 | " | Clergyman, | Hum. Cervix, | | | 25 " | 48 " | Used arm, |
| " | 36 | German, | Cartman, | Femur, | " | Run over, | 44 " | 44 " | 'Tolerable,' |
| " | 40 | Irish, | Laborer, | " | " | | 42 " | 84 " | Walked well, |
| " | 24 | American, | Painter, | Patella, | Simp. transverse, | | 33 " | 33 " | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Male, | 55 | American, | Carpenter, | Tibia and Fibula, | Simple, | | 42 days, | 42 days, | |
| " | 33 | Irish, | " | " " | | | 39 " | 39 " | Well, |
| " | 28 | German, | Sugar refiner, | Olecranon Ulnæ, | | Fall, | 25 " | 48 " | Had ab. in axil. |
| Female, | 76 | American, | | Cervix Femoris, | | " | 62 " | 67 " | Bears weight, |
| Male, | 30 | Irish, | Laborer, | Pubis, | | Jammed, | 46 " | 54 " | Well, |
| " | 23 | " | " | Femur, | Compound, | Blow, | 52 " | | Piece bone rem. |
| " | 40 | " | Seaman, | Tibia, | Simple, | | 31 " | 31 " | |
| " | 31 | " | Laborer, | Femur, | " | Fall of a car, | 'Some' in 42 | | Now in house, |
| " | 25 | " | Truckman, | " | " | Blow, | " | | " " |
| " | 25 | American, | Stone cutter, | Tibia, | " | Fall of stone, | | | " " |
| " | 9 | " | | Femur, | " | | Pretty firm 25 | | " " |
| " | 45 | English, | Laborer, | Tibia, | | | | | " " |

# TABLE

*Showing the proportionate number of cases of each bone fractured in three hundred and sixty-seven Hospital cases.*

| | |
|---|---|
| Fractures of the Tibia and Fibula, | 95 |
| " " Femur, | 69 |
| " " Tibia, singly, | 38 |
| " " Fibula, " | 20 |
| " " Humerus, | 18 |
| " " Radius, singly, | 9 |
| " " Radius and Ulna, | 6 |
| " " Ulna, singly, | 4 |
| " " Cranium, | 19 |
| " " Clavicle, | 26 |
| " " Ribs, | 24 |
| " " Sternum, | 2 |
| " " Cervix Femoris, | 10 |
| Miscellaneous cases, Scapula, Cervix Humeri, carpal and tarsal bones, Condyles, Olecranon and Acromion processes, | 27 |
| Total, | 367 |

This table shows there are six times as many fractures of the leg and thigh as of the arm and fore-arm, fracture of the leg being the most frequent accident, then the thigh, then the fore-arm, and lastly the arm.

# TABLES

*Showing the average time of union, and discharge from the Hospital, of a portion of the cases of simple and compound fracture.*

SIMPLE FRACTURE OF THE TIBIA AND FIBULA.

| Sex. | Age. | Time of Union. | When Discharged. | Av. union of 35 cases. | Av. union of 18 cases of 31 years and under. | Av. union of 17 cases upwards of 31 years. | Av. time of Discharge, 28 cases. |
|---|---|---|---|---|---|---|---|
| | Years. | Days. | Days. | | | | |
| Female, | 45 | 24 | 41 | | | | |
| Male, | 37 | 50 | 79 | | | | |
| " | 43 | 54 | 88 | | | | |
| " | 25 | 36 | 42 | | | | |
| Female, | 32 | 28 | — | | | | |
| Male, | 32 | 30 | 30 | | | | |
| " | 21 | 24 | 60 | | | | |
| " | 34 | 34 | — | | | | |
| Female, | 30 | 15 | 90 | | | | |
| Male, | 31 | 34 | 67 | | | | |
| " | 23 | 35 | 35 | | | | |
| " | 35 | 64 | 89 | | | | |
| " | 21 | 24 | 50 | | | | |
| " | 62 | 23 | 28 | | | | |
| Female, | 35 | 57 | 57 | 35.08 days. | 32.33 days. | 38.64 days. | 47.53 days. |
| Male, | 27 | 52 | — | | | | |
| " | 32 | 42 | 42 | | | | |
| " | 24 | 28 | 28 | | | | |
| " | 26 | 58 | 58 | | | | |
| " | 38 | 21 | 35 | | | | |
| " | 30 | 27 | 34 | | | | |
| " | 30 | 52 | 52 | | | | |
| " | 24 | 21 | 50 | | | | |
| Female, | 43 | 24 | 26 | | | | |
| Male, | 33 | 38 | — | | | | |
| " | 29 | 36 | 36 | | | | |
| " | 24 | 18 | 42 | | | | |
| " | 48 | 49 | — | | | | |
| " | 31 | 32 | — | | | | |
| " | 55 | 42 | — | | | | |
| " | 33 | 39 | 39 | | | | |
| " | 17 | 32 | 32 | | | | |
| " | 37 | 38 | 38 | | | | |
| " | 9 | 18 | 23 | | | | |
| " | 19 | 40 | 40 | | | | |

**Males, 29 cases, united in 35.86 days. Females, 5 cases, united in 29.06 days.**

COMPOUND FRACTURE OF THE TIBIA AND FIBULA.

| Sex. | Age. | Time of Union. | When Discharged. | Av. union of 16 cases. | Av. union for 8 cases of 27 years & upwards. | Av. union for 7 cases under 27 years. | Av. time of Discharge, 16 cases. |
|---|---|---|---|---|---|---|---|
| | Years. | Days. | Days. | | | | |
| Male, | 22 | 18 | 45 | | | | |
| " | 34 | 44 | 59 | | | | |
| " | — | 30 | 50 | | | | |
| " | 27 | 26 | 46 | | | | |
| " | 24 | 25 | 25 | | | | |
| " | 28 | 25 | 42 | 49.31 days. | 49.05 days. | 51.84 days. | 59.46 days. |
| " | 47 | 37 | 51 | | | | |
| " | 27 | 109 | 109 | | | | |
| " | 27 | 34 | 53 | | | | |
| " | 29 | 66 | — | | | | |
| " | 50 | 55 | — | | | | |
| " | 22 | 42 | 42 | | | | |
| " | 24 | 37 | — | | | | |
| " | 19 | 66 | 66 | | | | |
| Female, | 22 | 104 | 104 | | | | |
| Male, | 25 | 71 | 81 | | | | |

SIMPLE FRACTURE OF THE TIBIA.

| Sex. | Age. | Time of Union. | When Discharged. | Av. union of 12 cases. | Av. union of 6 cases of 40 years & upwards. | Av. union of 6 cases under 40 years. | Av. time of Discharge, for 7 cases. |
|---|---|---|---|---|---|---|---|
| | Years. | Days. | Days. | | | | |
| Female, | 33 | 17 | — | | | | |
| Male, | 46 | 25 | 36 | | | | |
| " | 40 | 29 | 59 | | | | |
| " | 11 | 23 | 25 | | | | |
| " | 43 | 26 | — | 27.41 days. | 31.33 days. | 23.05 days. | 35 days. |
| " | 29 | 22 | 22 | | | | |
| " | 48 | 49 | — | | | | |
| " | 33 | 23 | — | | | | |
| " | 40 | 28 | — | | | | |
| " | 26 | 32 | 48 | | | | |
| " | 33 | 24 | 24 | | | | |
| " | 40 | 31 | 31 | | | | |

COMPOUND FRACTURE OF THE TIBIA.

| Sex. | Age. | Time of Union. | When Discharged. | Av. union of 17 cases. | Av. union for cases. | Av. union for cases. | Av.time of Dis.5cases. |
|---|---|---|---|---|---|---|---|
| | Years. | Days. | Days. | | | | |
| Male, | 46 | 120 | 120 * | | | | |
| " | — | 32 | 46 | | | | |
| " | 34 | 24 | 28 | 67 days. | | | 71.02 days. |
| " | 29 | 121 | 121 ** | | | | |
| " | 40 | 41 | 41 | | | | |
| " | 35 | 32 | — | | | | |
| " | 35 | 99 | *** | | | | |

* Necrosis. ** Piece of bone removed. *** "Much relieved," and union.

SIMPLE FRACTURE OF THE FIBULA.

| Sex. | Age. | Time of Union. | When Discharged. | Av. union of 16 cases. | Av. union of 8 cases of 32 years and under. | Av. union of 8 cases upwards of 32 yrs. | Av. time of Discharge, 10 cases. |
|---|---|---|---|---|---|---|---|
| | Years. | Days. | Days. | | | | |
| Male, | 24 | 20 | 27 | | | | |
| " | 32 | 19 | 19 | | | | |
| " | 50 | 15 | 15 | | | | |
| " | 22 | 22 | 32 | | | | |
| " | 45 | 17 | 28 | 26.43 days. | 22 days. | 30.87 days. | 30 days. |
| " | 22 | 14 | 21 | | | | |
| Female, | 21 | 17 | 26 | | | | |
| Male, | 32 | 20 | — | | | | |
| " | 19 | 35 | — | | | | |
| " | 54 | 21 | — | | | | |
| " | 38 | 24 | — | | | | |
| " | 24 | 29 | — | | | | |
| Female, | 36 | 43 | | | | | |
| " | 57 | 35 | 35 | | | | |
| Male, | 40 | 47 | 47 | | | | |
| " | 40 | 45 | 45 | | | | |

COMPOUND FRACTURE OF THE FIBULA.

| Sex. | Age. | Time of Union. | When Discharged. | Av. union of 2 cases. | | | |
|---|---|---|---|---|---|---|---|
| | Years. | Days. | Days. | Days. | | | |
| Female, | 28 | 42 | 42 | 36.05 | | | |
| Male, | 38 | 31 | — | | | | |

FRACTURE OF THE PATELLA.

| Sex. | Age. | Time of Union. | When Discharged. | Av. union of 6 cases. | Av. union of 3 cases of 30 years & upwards. | Av. union of 3 cases under 30 years. | Av. time of Discharge for 4 cases. |
|---|---|---|---|---|---|---|---|
| | Years. | Days. | Days. | | | | |
| Male, | 21 | 86 | — | | | | |
| " | 21 | 56 | — | | | | |
| " | 30 | 21 | 56 | 40.83 days. | 23.23 days. | 58.33 days. | 41 days. |
| " | 43 | 30 | 45 | | | | |
| " | 31 | 19 | 30 | | | | |
| " | 24 | 33 | | | | | |

FRACTURE OF THE CERVIX FEMORIS.

| Sex. | Age. | Time of Union. | When Discharged. | | Av. union of 6 cases. | | Av. time of Discharge for 3 cases. |
|---|---|---|---|---|---|---|---|
| | Years. | Days. | Days. | | | | |
| Male, | 64 | 0 | 130 | No relief. | | | |
| " | 39 | 23 | — | | | | |
| " | 56 | 38 | — | | 43.83 days. | | 81.66 days. |
| " | 40 | 65 | — | | | | |
| Female, | 57 | 38 | 84 | | | | |
| " | 73 | 38 | 94 | | | | |
| " | 76 | 62 | 67 | | | | |

SIMPLE FRACTURE OF THE FEMUR.

| Sex. | Age. | Time of Union. | When Discharged. | Av. union of 35 cases. | Av. union of 18 cases of 30 years and under. | Av. union of 17 cases upwards of 30 yrs. | Av. time of Discharge of 27 cases. |
|---|---|---|---|---|---|---|---|
| | Years. | Days. | Days. | | | | |
| Male, | 22 | 18 | 45 | | | | |
| " | 16 | 25 | 30 | | | | |
| " | 24 | 23 | 30 | | | | |
| " | 39 | 28 | 64 | | | | |
| " | 40 | 108 | 114 | | | | |
| " | 21 | 48 | 48 | | | | |
| " | 13 | 22 | — | | | | |
| " | 33 | 41 | — | | | | |
| " | 47 | 40 | 69 | | | | |
| " | 36 | 22 | — | | | | |
| " | 22 | 57 | 57 | | | | |
| " | 40 | 44 | 44 | | | | |
| " | 38 | 33 | 33 | | | | |
| " | 21 | 32 | — | | | | |
| " | 32 | 42 | 42 | | | | |
| " | 3 | 21 | — | | | | |
| " | 36 | 22 | 35 | | | | |
| " | 30 | 37 | — | | | | |
| " | 7 | 20 | 26 | | | | |
| " | 22 | 46 | 80 | | | | |
| " | 30 | 38 | 38 | | | | |
| " | 25 | 43 | 43 | | | | |
| " | 36 | 50 | 50 | | | | |
| " | 25 | 42 | — | | | | |
| Female, | 45 | 76 | 76 | | | | |
| Male, | 30 | 69 | 69 | | | | |
| " | 24 | 31 | 42 | | | | |
| " | 45 | 37 | — | | | | |
| " | 51 | 54 | 71 | | | | |
| " | 15 | 32 | 35 | | | | |
| " | 30 | 42 | 42 | | | | |
| " | 44 | 34 | 70 | | | | |
| " | 33 | 14 | 14 | | | | |
| " | 36 | 44 | 44 | | | | |
| " | 40 | 42 | 84 | | | | |
| | | | | 37.62 days. | 35.88 days. | 43 days. | 51.29 days. |

By taking out the remarkable case in which the period of union occupied one hundred and eight days, the average time of union for the whole will be 36.25 days. For the older class of cases, 36.64 days. For the younger class, 35.88 days.

SIMPLE FRACTURE OF RADIUS AND ULNA.

| Sex. | Age. | Time of Union. | When Discharged. | |
|---|---|---|---|---|
| | Years. | Days. | Days. | |
| Male, | 40 | 14 | — | Average union, 20.66 days. |
| Female, | 43 | 20 | 20 | |
| Male, | 27 | 28 | 28 | |

SIMPLE FRACTURE OF THE ULNA.

| Sex. | Age. | Time of Union. | When Discharged. | |
|---|---|---|---|---|
| | Years. | Days. | Days. | |
| Male, | 27 | 28 | — | Average union, 31.66 days. |
| Female, | 43 | 20 | — | |
| Male, | 40 | 47 | 47 | |

SIMPLE FRACTURE OF THE RADIUS.

| Sex. | Age. | Time of Union. | When Discharged. | Av. union of 3 cases. | | | Av. time of Discharge. |
|---|---|---|---|---|---|---|---|
| | Years. | Days. | Days. | Days. | | | Days. |
| Male, | 13 | 13 | 32 | 23 | | | 44.33 |
| " | 22 | 22 | 31 | | | | |
| " | 14 | 34 | 70 | | | | |

SIMPLE FRACTURE OF THE HUMERUS.

| Sex. | Age. | Time of Union. | When Discharged. | Av. union of 10 cases. | Av. union of 4 cases upwards of 30 years. | Av. union of 6 cases of 21 years & under. | Av. time of Discharge. |
|---|---|---|---|---|---|---|---|
| | Years. | Days. | Days. | | | | |
| Male, | 37 | 20 | 32 | 26.05 days. | 28.05 days. | 25.16 days. | 36.62 days. |
| " | 21 | 26 | 28 | | | | |
| " | 18 | 16 | 18 | | | | |
| " | 33 | 36 | — | | | | |
| " | 12 | 31 | 31 | | | | |
| Female, | 36 | 21 | 44 | | | | |
| Male, | 15 | 30 | 30 | | | | |
| " | 21 | 24 | 60 | | | | |
| " | 21 | 24 | 50 | | | | |
| " | 42 | 37 | — | | | | |

SIMPLE FRACTURE OF THE CLAVICLE.

| Sex. | Age. | Time of Union. | When Discharged. | Av. union of 13 cases. | Av. union of 7 cases under 30 years. | Av. union of 6 cases upwards of 30 years. | Av. time of Discharge, 12 cases. |
|---|---|---|---|---|---|---|---|
| | Years. | Days. | Days. | | | | |
| Male, | 35 | 14 | 28 | 21.15 days. | 20.85 days. | 21.05 days. | 28.25 days. |
| Female, | 44 | 19 | 34 | | | | |
| Male, | 24 | 29 | 45 | | | | |
| " | 36 | 22 | 35 | | | | |
| " | 21 | 14 | 14 | | | | |
| " | 21 | 18 | — | | | | |
| Female, | 20 | 28 | 31 | | | | |
| Male, | 28 | 16 | 16 | | | | |
| Female, | 40 | 22 | 31 | | | | |
| " | 22 | 31 | 31 | | | | |
| " | 48 | 34 | 34 | | | | |
| Male, | 48 | 18 | 20 | | | | |
| " | 28 | 10 | 10 | | | | |

Average union in the different sexes—Males, 8 cases, 17.62 days. Females, 5 cases, 26.08 days.